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EFFECTS OF DREDGING AND LAKEFILLING AT THE TORONTO HARBOUR AND EAST HEADLAND IN 1982 AND 1983

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EFFECTS OF DREDGING AND LAKEFILLING

AT THE TORONTO HARBOUR AND EAST HEADLAND

IN 1982 AND 1983

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GREAT LAKES SECTION
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ABSTRACT

The Great Lakes Section of the Ontario Ministry of the Environment continued surveillance of dredging and lakefilling activities at the Toronto Harbour and East Headland (Leslie Street spit) in 1982 and 1983 in order to assess the potential for contaminants associated with dredged material and lakefill material to adversely affect water quality. Nine surveys were carried out between September 1982 and June 1983 covering a wide range of environmental conditions. Various sampling techniques were employed including aerial observation, turbidity profiling, suspended solids sampling, and dredged material sampling, in addition to water quality sampling. Short-term effects on surface (1.5 m) water quality, determined by sampling for physical parameters, nutrients, and metals, were found to be localized and generally subordinate to the influence of the Don River and Main sewage treatment plant (STP). There was no indication of any direct adverse impacts on recreational water use or drinking water supplies and the infrequent detection of trace organics in water samples could not be attributed to either dredging or lakefilling activity. Preliminary investigations demonstrated that surface turbidity was not a reliable indicator of subsurface conditions during calm weather since increased turbidity was found to occur near the lake bed at most stations. Other preliminary results demonstrated the potential for long-term (i.e. seasonal) effects on area sediment quality due to the migration of suspended sediment particles with elevated levels of adsorbed contaminants.

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1. INTRODUCTION

1.1 1982/83 Study Rationale and Objectives

The Great Lakes Section of the Ontario Ministry of the Environment (MOE) continued surveillance of dredging and lakefilling activities at the Toronto waterfront (Figure 1.1) throughout the fall of 1982 and in the spring and summer of 1983 in order to assess their impacts on water quality. (Note: a summary of dredging and lakefilling activities is contained in Section 2). Dredging near the mouth of the Keating Channel, lakefilling at the East Headland, and dredged spoils disposal at the East Headland Cell #1 (Figure 1.1) were monitored to investigate their potential to adversely affect water quality through re-introduction into the water column of contaminants associated with dredged spoils and lakefill material.

1.1.1 Surveys in 1982

Seven surveys, from September to December 1982, were designed to complement previous studies (Griffiths 1980, 1983; Griffiths and Winiecki 1981) by investigating the extent and contaminant status of surface plumes associated with dredging and lakefilling activities under calm and adverse weather conditions. Assessment under adverse weather conditions was required since previous conclusions regarding the localized nature of water quality effects had not included periods of high winds and/or intense precipitation. The target criteria for such adverse weather conditions were daily wind speeds greater than 20 km/h and/or a daily precipitation accumulation of greater than 25 mm, although these were not always precisely achieved.

In addition to in-lake water quality sampling, limited sampling of untreated (raw) drinking water at the Toronto Island and R.C. Harris filtration plants was undertaken as was sampling of treated effluent at the Main Toronto sewage treatment plant (STP). Limited sediment sampling of dredged spoils and suspended solids from the vicinity of the East Headland was also completed and extensive aerial surveillance was maintained.

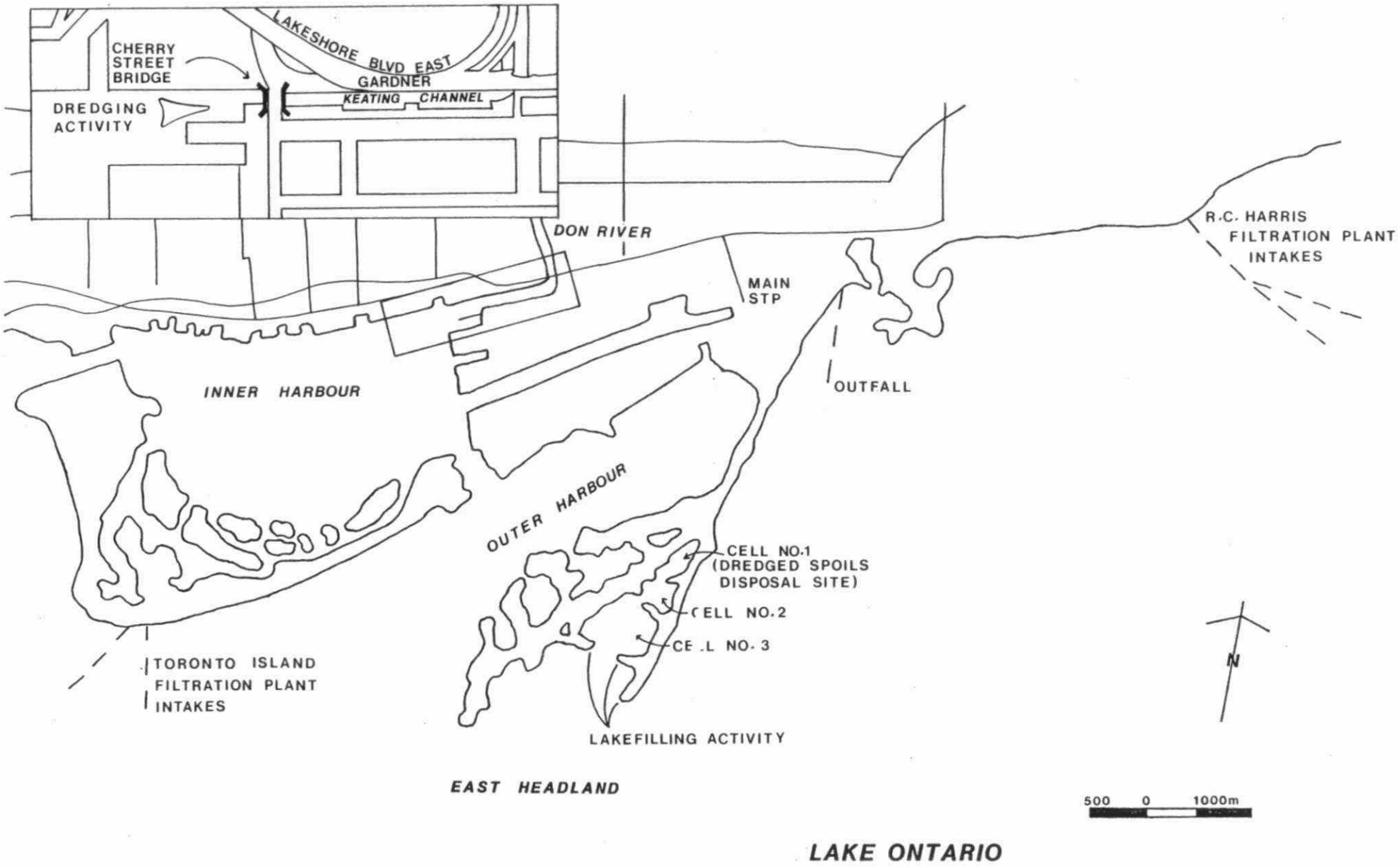

Figure 1.1: Study Area

Five surveys were performed under adverse weather conditions, three concentrating on lakefilling under high winds, one investigating dredging following high precipitation, and one investigating dredged spoils disposal following high precipitation. For comparative purposes, two surveys were undertaken during calm conditions, one assessing dredging, and one assessing lakefilling. Detailed descriptions of the individual surveys are included in Section 3.

1.1.2 Surveys in 1983

Two surveys were carried out in April and June 1983 under calm conditions. These were designed to investigate the extent and contaminant status of subsurface turbidity plumes from dredging and lakefilling activities as estimated by turbidity versus depth profiles. This shift in emphasis from surface water to water column investigations was necessitated by preliminary turbidity profiling results and diver observations in 1982 which indicated that under calm conditions considerable movement of suspended solids occurred at depth despite the absence of an extensive or well defined plume at the surface. Individual surveys are described in detail in Section 3.

1.1.3 Data Presentation and Analysis

Each of the nine surveys carried out between September 1982 and June 1983 covered a wide range of environmental conditions and subsequently differed either in terms of exact sampling locations or method of turbidity plume measurement. As a result, the sample size of water quality results for most stations, under specific environmental conditions, was small. For ease of interpretation, therefore, survey results have been presented independently. This survey-by-survey presentation of data has isolated results for similar environmental conditions allowing a qualitative assessment of the spatial variation in water quality parameters (including physical tests, nutrients, heavy metals, and trace organics) associated with the various activities and environmental conditions under investigation.

Throughout the report, water quality results have been grouped according to whether they were collected during calm or adverse weather conditions. Section 2 briefly summarizes the 1982/83 dredging and lakefilling activities and their history while Section 3 describes the survey methods, stations, and environmental conditions for each of the calm and adverse weather surveys. Turbidity plume tracking and observation in the field are discussed in Section 4 as a prerequisite for the water chemistry results (physical parameters and nutrients, heavy metals, and trace organics) which follow in Sections 5, 6, and 7, respectively. Results of sediment anlysis are presented in section 8. Section 9 contains a summary of the various sampling results and Section 10 outlines future investigations.

Summary tables of selected parameters are used for discussion purposes in the report text; a complete list of water and sediment quality parameters and all results of analysis are included as Appendix A.

2. SUMMARY OF DREDGING AND LAKEFILLING ACTIVITY 1982/83

2.1 Lakefilling

Construction of the East Headland (also known as the Leslie Street Spit or Outer Harbour East Headland) by the Toronto Harbour Commission (THC) continued throughout 1982 and 1983. Since 1956 over 25 x 10^6 m^3 of trucked fill and dredged spoils have been used to construct the East Headland and Aquatic Park's 188 ha (THC 1983). Detailed information regarding the filling and armouring procedures is available from the THC.

Lakefilling operations since 1979 have been primarily directed towards the construction of three disposal cells (Figure 2.1). The year-by-year progress has been illustrated in Figure 2.1. Details of the projected East Headland configuration are also available from the THC.

In 1982 an estimated 1,216,345 m^3 of trucked fill were used to create an additional 2.88 ha of land (THC 1982), and in 1983 an estimated 895,430 m^3 were used to create 1.62 ha (THC 1983).

The Provincial Lakefill Quality Assurance Programme (LQAP) was initiated in August 1982 to minimize the receipt of contaminated fill at the East Headland from excavation sites within the City of Toronto. Details of this programme can be obtained from the Central Regional office of the Ministry of the Environment.

2.2 Dredging and Spoils Disposal

In 1982 and 1983 dredging by the THC continued in the Inner Harbour, chiefly in the northeast corner to the west of the Keating Channel (Figure 1.1). By the end of 1983 a total of approximately 1.6 x 10^6 m^3 of dredged spoils from the Inner Harbour had been disposed of at the East Headland (THC 1983). Since 1980 this material has been placed in the East Headland Cell #1 after being transported from the Inner Harbour by a bottom dump scow.

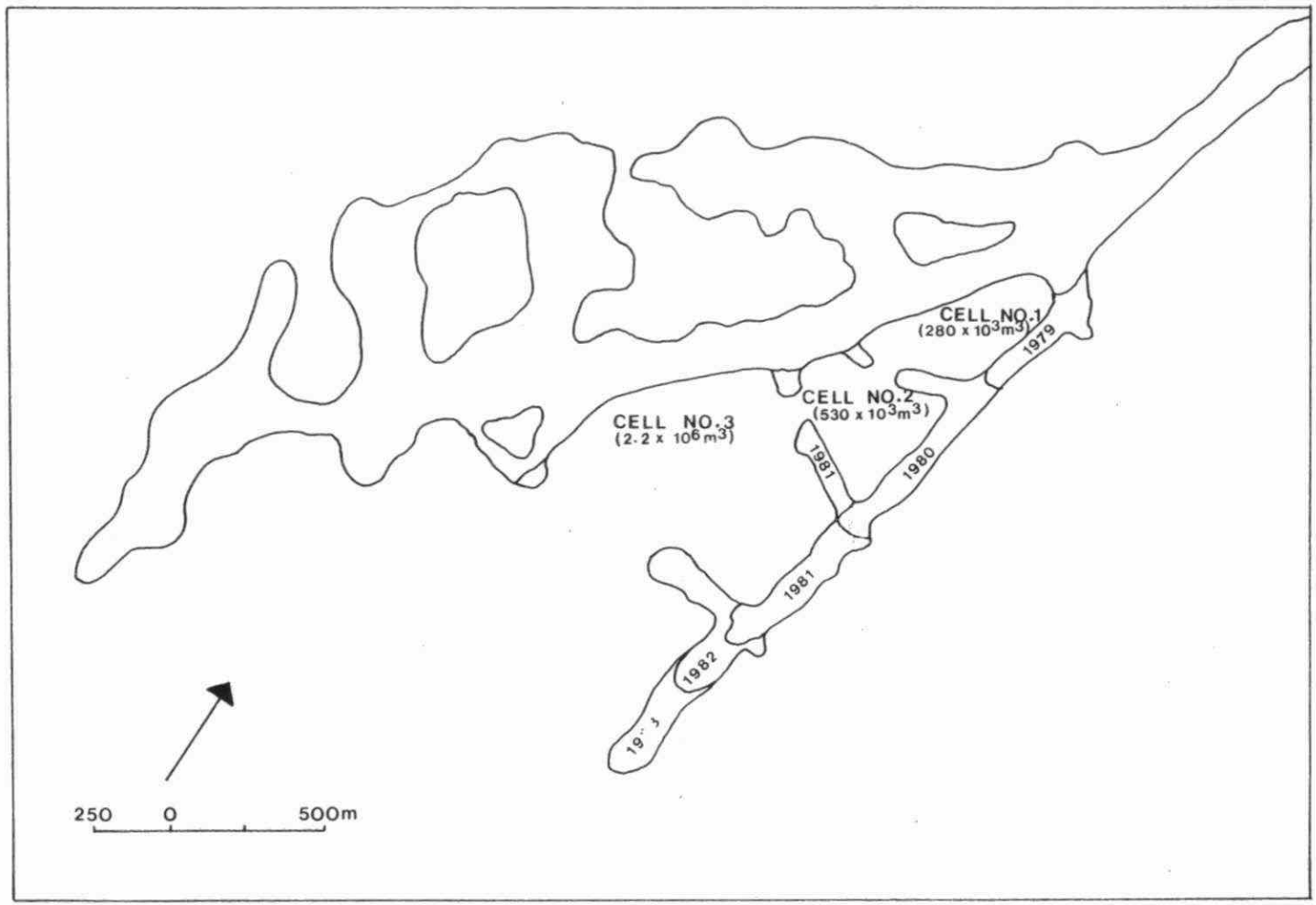

FIGURE 2.1 Recent Lakefilling at the East Headland

Dredging operations during 1982 commenced in April and ran through until December with an estimated total of 73,010 m^3 being deposited in Cell #1 (THC 1982). A more limited programme was conducted in 1983 with dredging occurring only during May through July, and October through December with an estimated total of 29,760 m^3 being placed in Cell #1 (THC 1983).

3 SURVEY DESCRIPTIONS

3.1 Field Methods

Each calm and adverse weather survey incorporated one or more of the following components.

(a) Surface transects with Turner nephelometer

The extent of surface turbidity was assessed by repeated sampling along transects over a 250 m grid and monitoring the continuous results from the flow-through nephelometer* fed by pump from a depth of 1.5 m. The nephelometer yielded results in NTU (calibrated against an FTU standard to give linear results between 0 and 40 NTU).

Although the nephelometer was extremely sensitive to small fluctuations in turbidity the results were of limited accuracy due to artificial increases resulting from pressure induced precipitation of dissolved gases within the pumped water being monitored. A further limitation of this approach was the excessive amount of time required to complete the surface plume assessment prior to additional sampling. For these reasons this approach was discontinued and replaced by aerial surveillance.

(b) Aerial Observation of Surface Turbidity

Low altitude (300-400 m) aerial surveillance of the study area was undertaken from single engine aircraft operating out of the Toronto Island airport. This provided a means of rapidly assessing surface turbidity and prevailing surface currents throughout the study area nearshore zone in general, and allowed a qualitative assessment of the extent and direction of turbidity plumes in the northeast corner of the Inner Harbour and in the vicinity of the East Headland. A typical overflight lasted approximately half an hour and was followed by in-lake sampling at selected locations in the turbidity plumes within 1-2 hours of overflight completion.

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* Nephelometric measurement of turbidity records the amount of light scattered through 90^{o} by suspended particles.

This approach could only be used when weather conditions were suitable for flying and required advance notification to ensure that a pilot was available.

(c) Water Quality Sampling

Water quality was sampled along the centre-lines of turbidity plumes and at other fixed locations (Figures 3.1, 3.2). Samples were pumped from variable depths through a teflon hose and appropriate containers were filled for the required range of tests (Appendix A1) according to MOE analytical methods (Ontario Ministry of the Environment 1983).

A blank was obtained for the inorganic trace contaminant laboratory on November 5, 1982 by pouring approximately 2 litres of double distilled H_2O through the pump-hose system.

Samples of untreated (raw) water at the R.C. Harris filtration plant were pumped through a line from the holding well at the end of the intake pipes, while samples at the Toronto Island plant were obtained directly from the intake. In both cases no filtering, alum treatment, or pre-chlorination of the water occurred prior to sampling.

Samples of treated effluent at the Main STP were obtained directly after chlorination but with no allowance for chlorine contact time.

(d) Transmissometer Profiles

Turbidity versus depth profiles in 1982 were obtained by a transmissometer package on loan from the Canada Centre for Inland Waters (C.C.I.W.) in Burlington. This consisted of a 0.25 m path-length transmissometer giving a percentage transmittance (calibrated to 82% in air) output, a pressure depth sensor with output in feet (0 in air), and an X-Y recorder to provide continuous turbidity - depth tracings.

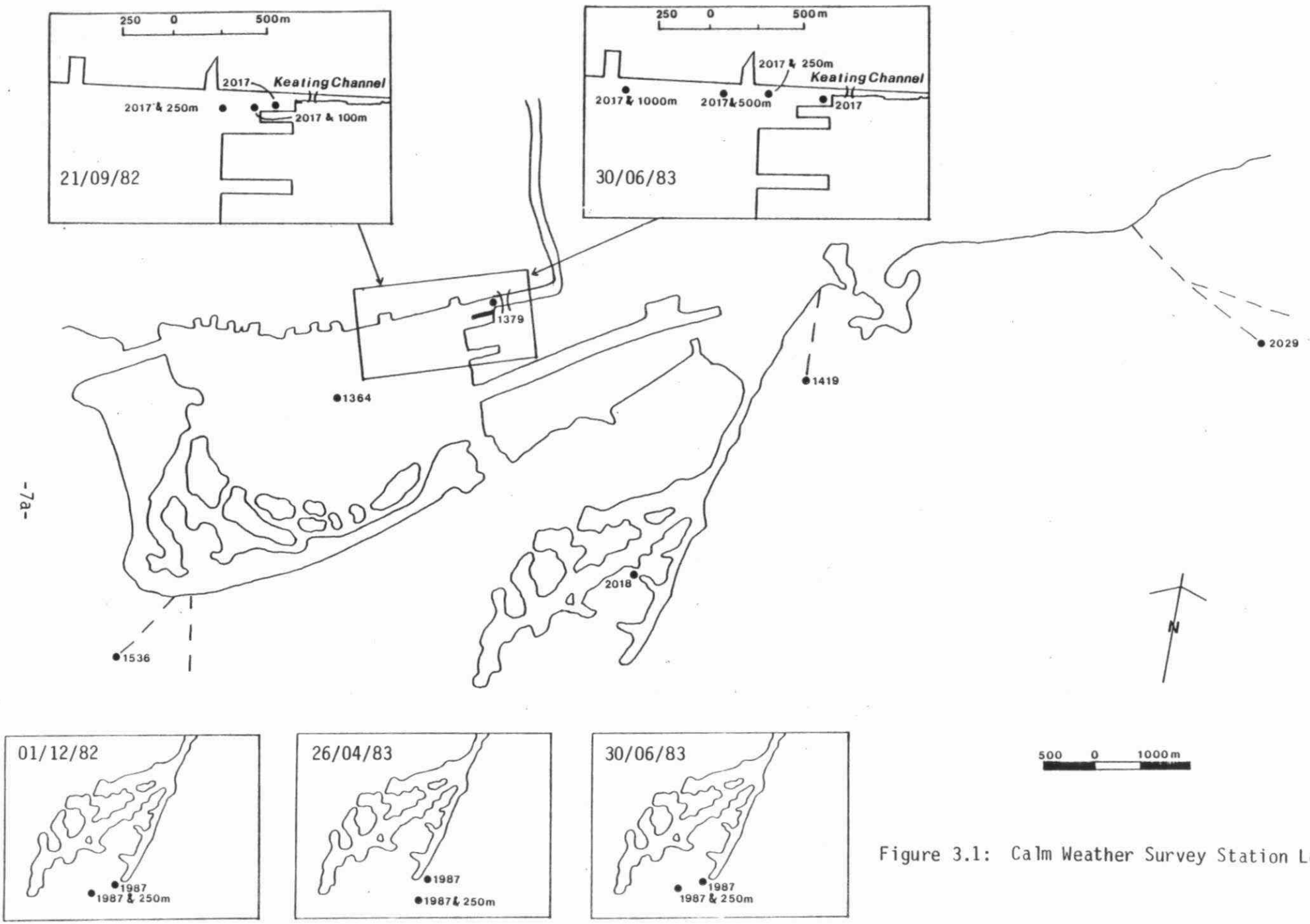


Figure 3.1: Calm Weather Survey Station Locations

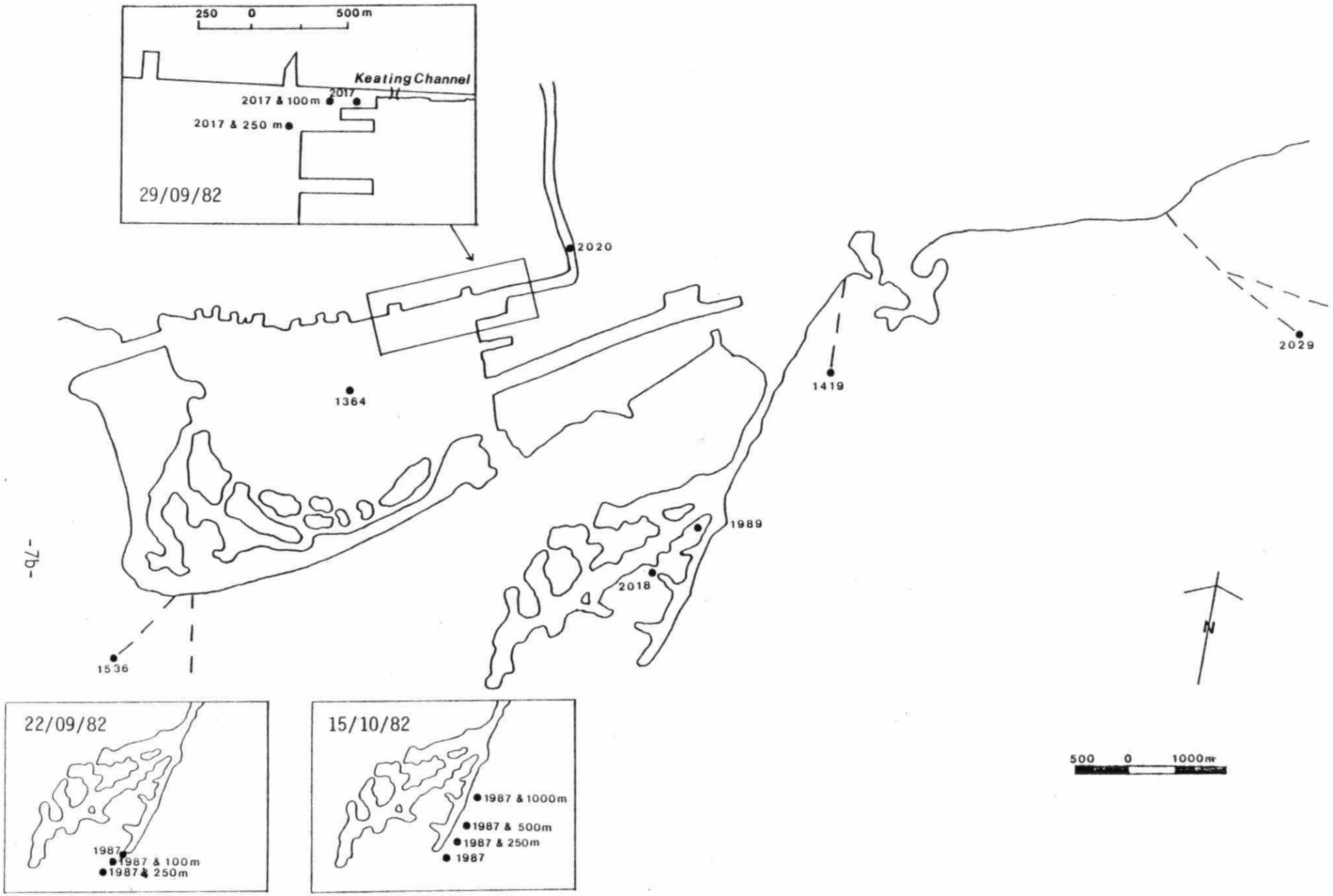


Figure 3.2: Adverse Weather Survey Station Locations

(e) Nephelometer Profiles

In 1983 turbidity versus depth profiles were obtained by repeated sampling with the Turner nephelometer (as used in "a"; a transmissometer package was designed and ordered but was not available for the 1983 field season). A series of depths were sampled by pump, typically at intervals of 2-3 m, and the output from the nephelometer was recorded in "Turner" units. Although the Turner nephelometer was calibrated to an FTU standard the output was recorded on a scale from 1-10 (rather than 0-40 NTU) since relative results were of prime concern and because the previously stated limitations of this device meant that use of the NTU scale was misleadingly precise.

(f) Sediment Grab Sampling

A grab sample of dredged spoils was obtained by hand (on September 21, 1982) using the appropriate glass jars for the tests requested (Appendix A5). A composite surface sample was scooped from four locations on the T.H.C. scow during dredging operations.

(g) Suspended Sediment Sampling

Suspended sediment samples were concentrated from pumped near-surface (1.5 m) lake water at a rate of approximately 6 l/s by means of a flow-through centrifuge. Stations were sampled continuously for 2-3 hours, depending upon the suspended solids concentration in the lake water, in order to yield a sufficient quantity of sediment for laboratory analysis.

3.2 Calm Weather Surveys

Four calm weather surveys were undertaken over the period September 1982 to June 1983. The first, on September 21, 1982, investigated effects of dredging in the northeast corner of the Inner Harbour (Figure 1.1) while the second, carried out on December 1, 1982,

assessed the effects of lakefilling at the East Headland (Figure 1.1). A third survey, on April 26, 1983, again concentrated on lakefilling effects while the final survey, completed on June 30, 1983, assessed effects of dredging, lakefilling, and dredged spoils disposal at the East Headland Cell #1 (Figure 1.1). Table 3.1 summarizes the calm weather environmental conditions and survey activities and Figure 3.1 shows water quality sampling locations.

3.3 Adverse Weather Surveys

Five surveys were carried out between September 22 and November 5, 1982 during high winds or following intense precipitation. The first, on September 22, investigated lakefilling at the East Headland (Figure 1.1) during high winds, the second studied dredging in the northeast corner of the Inner Harbour (Figure 1.1) on September 29 following intense precipitation, the third provided a lakefilling assessment on October 15 during high winds, the fourth concentrated on dredged spoils disposal at the East Headland Cell #1 (Figure 1.1) on November 4 following intense precipitation, and the fifth investigated lakefilling on November 5 during high winds, following high precipitation. Table 3.2 summarizes the adverse weather environmental conditions and survey activities and Figure 3.2 indicates the locations of water quality sampling stations.

TABLE 3.1 CALM WEATHER SURVEY ACTIVITY SUMMARY

	SURVEY DATES			
	September 21, 1982	December 1, 1982	April 26, 1983	June 30, 1983
Principal Component of Survey	dredging in NE corner of Inner Harbour	lakefilling at East Headland, no dredging	lakefilling at East Headland, no dredging	dredging and lakefilling activities
Antecedent precipitation	none during previous 24 hours	none during previous 24 hours	trace during day of survey	none during previous 24 hours
Winds During Survey	from E at 9 km/h	from E at 5 km/h	from NW at 5 - 10 km/h	from ESE at 10 km/h
Daily Average L. Ontario Currents	to NE then SW at 4 cm/s	to SW at 10 cm/s	to SW (no current meter record)	to SW (no current meter record)
Surface Turbidity Assessment	surface transects with nephelometer	surface observation at East Headland	aerial observation at East Headland	aerial observation of Harbour/East Headland
*	*	*	*	*
Don River (2020)	WQ sample at 0.1 m			
Cherry St. bridge (1379)		transmiss. profile and WQ sample at 1.5 m		
Dredge Site (2017)	WQ sample at 1.5 m			nephelom. profile and WQ sample at 2.0 m
Dredge Site + 100 m	WQ sample at 1.5 m			
Dredge Site + 250 m	WQ sample at 1.5 m			nephelometer profile only
Dredge Site + 500 m				nephelometer profile only
Dredge Site + 1000 m				nephelometer profile only
Inner Harbour (1364)	WQ sample at 1.5 m depth	transmiss. profile and WQ sample at 1.5 m		nephelom. profile and WQ sample at 1.5 m
Island intake (1536)	WQ sample at 1.5 m	transmiss. profile and WQ sample at 1.5 m	nephelom. profile and WQ sample at 1.5 m	nephelom. profile and WQ sample at 6.5 m
Island in-plant untreated	WQ sample			
Headland Cell #2 (2018)				nephelom. profile and WQ sample at 3.5 m
Lakefilling (1987)		transmiss. profile and WQ sample at 1.5 m	nephelom. profile and WQ sample at 6.0 m	nephelom. profile and WQ sample at 5.5 m
Lakefilling + 250 m		transmiss. profile and WQ sample at 1.5 m	nephelometer profile only	nephelometer profile only
Main STP in-plant treated effluent	WQ sample	WQ sample		
Main STP outfall (1419)	WQ sample at 1.5 m	transmiss. profile and WQ sample at 1.5 m	nephelom. profile and WQ sample at 1.5 m	nephelom. profile and WQ sample at 5.0 m
R.C. Harris intake (2029)	WQ sample at 1.5 m	transmiss. profile and WQ sample at 1.5 m	nephelom. profile and WQ sample at 12 m	nephelom. profile and WQ sample at 12 m
R.C. Harris in-plant untreated (raw)	WQ sample	WQ sample		
T.H.C. dredge scow dredged material	sediment grab sample			

WQ = water quality (sampled by submerged pump through teflon hose)
transmiss. = transmissometer package (including depth sensor and X-Y recorder)

nephelom. = flow-through nephelometer (fed by submerged pump)

Daily average L. Ontario currents from Kohli (1984).

TABLE 3.2 ADVERSE WEATHER SURVEY ACTIVITY SUMMARY

	SURVEY DATES				
	September 22, 1982	September, 29 1982	October 15, 1982	November 4, 1982	November 5, 1982
Principal Component of Survey	lakefilling at East Headland, no dredging	dredging in NE corner of Inner Harbour	lakefilling at East Headland, no dredging	dredged spoils disposal at East Headland	lakefilling at East Headland
Antecedent precip. at Island stn.	5.8 mm during previous 24 hours	25 mm during previous 24 hours	2.2 mm during previous 24 hours	33 mm during previous 48 hours	8 mm during previous 24 hours
Winds During Survey	from E at 20 km/h waves 1.0-1.2 m	from E at 13 km/h	from NW at 30-40 km/h waves 0.6-0.9 m	from NW at 10-15 km/h	from WNW at 35-40 km/h waves 0.6-1.0 m
Daily Average L. Ontario Currents	to SW at 11 cm/s	to SW at 6 cm/s	to NE (no current meter record)	to SSW (no current meter record)	to NE (no current meter record)
Surface Turbidity Assessment	surface observation at East Headland	surface transects with nephelometer	aerial observation at at East Headland	aerial observation of East Headland	aerial observation of East Headland
*	*	*	*	*	*
Don River (2020)		WQ at 0.1 m			
Dredge Site (2017)		WQ at 1.5 m			
Dredge Site + 100 m		WQ at 1.5 m			
Dredge Site + 250 m		WQ at 1.5 m			
Inner Harbour (1364)		WQ at 1.5 m			
Island intake (1536)	WQ sample at 1.5 m	WQ sample at 1.5 m	transmiss. profile and WQ sample at 1.5 m		
Headland Cell #1 (1989)				transmiss. profile, WQ and SS sample from 1.5 m	
Headland Cell #2 (2018)				transmiss. profile, WQ and SS sample from 1.5 m	
Lakefilling (1987)	WQ sample at 1.5 m		transmiss. profile and WQ sample at 1.5 m		
Lakefilling + 100 m	WQ sample at 1.5 m				
Lakefilling + 250 m	WQ sample at 1.5 m		transmiss. profile and WQ sample at 1.5 m		
Lakefilling + 500 m			transmiss. profile and WQ sample at 1.5 m		transmiss. profile, WQ and SS sample from 1.5 m
Lakefilling + 1000 m			transmiss. profile and WQ sample at 1.5 m		
Main STP in-plant treated effluent			WQ sample		
Main STP outfall (1419)	WQ sample at 1.5 m		transmiss. profile and WQ sample at 1.5 m		
R.C. Harris intake (2029)	WQ sample at 1.5 m		transmiss. profile and WQ sample at 1.5 m		

WQ = water quality (sampled by submerged pump through teflon hose)
SS = suspended sediment (sampled by submerged pump and flow-through centrifuge)
transmiss. = transmissometer package (including depth sensor and X-Y recorder)

4. IN-LAKE TURBIDITY PLUME TRACKING/AERIAL SURVEILLANCE RESULTS

Observation and tracking of surface turbidity plumes was of prime importance since it provided an indication of the direct zone of influence at both dredging and lakefilling operation sites. Previous investigations have shown that turbidity levels alone are generally not sufficiently elevated to have a direct impact on aquatic life or recreation (Griffiths 1980, 1983; Griffiths and Winiecki 1981). However, since a strong positive correlation exists between concentration of suspended solids and turbidity, and since in an urban environment such as the Toronto waterfront the probability of detection of parameters with low solubility such as heavy metals and trace organics increases with the concentration of fine suspended sediment particles (Forstner and Wittman 1981), delineation of turbidity plumes provides a reasonable basis for water quality sampling locations.

Field measurements adequately illustrated differences in turbidity between stations although they lacked the accuracy of the laboratory measurements made on submitted water quality samples. This accounts for differences between the on-board results presented in this section and laboratory results which are dicussed in Section 5.

Surface plume tracking and/or aerial surveillance were used to estimate the extent and direction of surface plumes and to delineate their centre-lines at either the northeast corner of the Inner Harbour or in the vicinity of the East Headland. Turbidity versus depth profiles were also obtained within the observed surface plumes as a means of documenting differences between surface and subsurface conditions. Tables 3.1 and 3.2 indicate the procedures used on the individual survey days and the corresponding environmental conditions.

4.1 Calm Weather Surveys

4.1.1 Dredging

September 21, 1982:

Surface plume tracking of the Inner Harbour on September 21, 1982 demonstrated that the surface plume was confined to the northeast corner of the Inner Harbour with the highest level of 19 NTU being recorded next to the dredge (Figure 4.1.1a). The absence of precipitation had resulted in no extensive intrusion of the Don River plume into the central harbour. The harbour station (1364) had a turbidity level of 5 NTU reflecting the extremely localized elevations due to dredging. In comparison, levels recorded in Lake Ontario over the Toronto Island filtration plant intake (1536), the R.C. Harris filtration plant intake (2029), and the Main STP outfall (1419) were 3 NTU, 2 NTU, and 5 NTU respectively.

June 30, 1983:

Aerial surveillance on June 30, 1983 determined that the surface plume in the northeast corner of the Inner Harbour extended for more than 1000 m into the Inner Harbour in a narrow band along the north wall (Figure 4.1.1b). Turbidity depth profiling results (Figure 4.1.1c) for the dredge site (2017) showed a higher surface turbidity than the open lake (5.5 Turner units) and increased to a maximum of 10 Turner units (approximately 40 FTU) at a depth of 2 m. Results for 250, 500, and 1000 m downrange along the Inner Harbour north wall all revealed maximum turbidities at the surface with values diminishing as the distance from the northeast corner of the Inner Harbour increased.

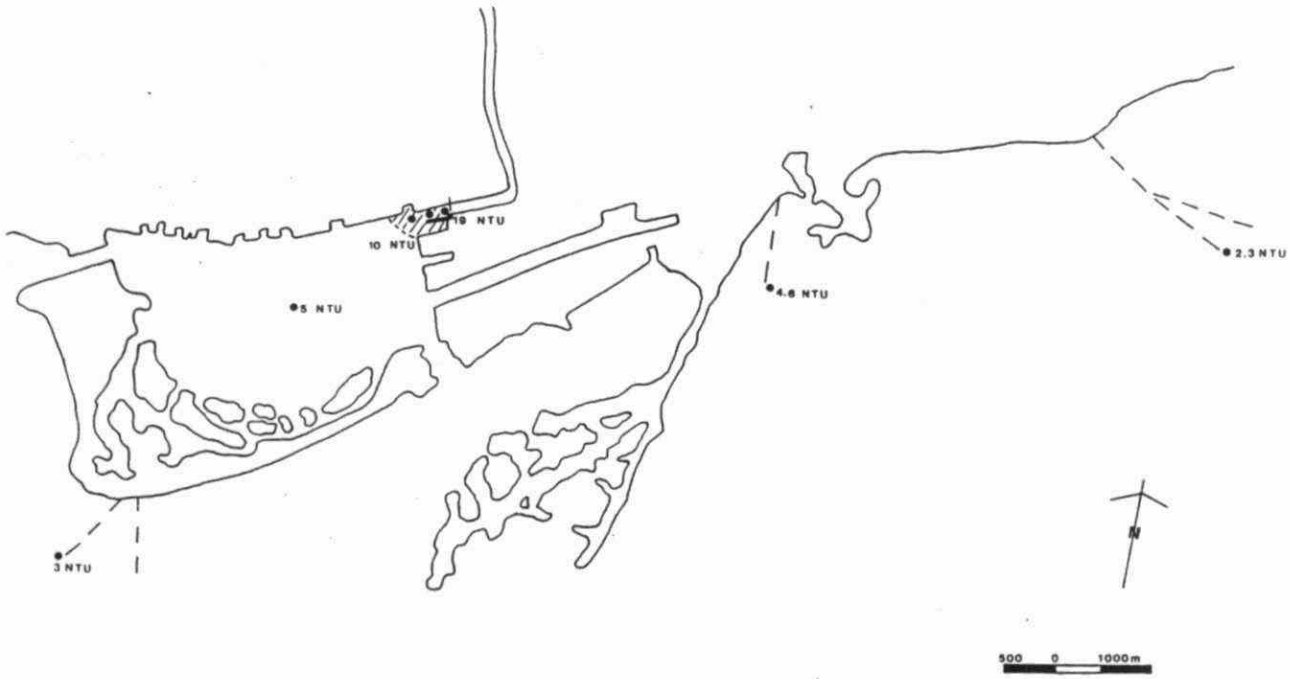


Figure 4.1.1a: Surface Turbidity During Dredging September 21, 1982

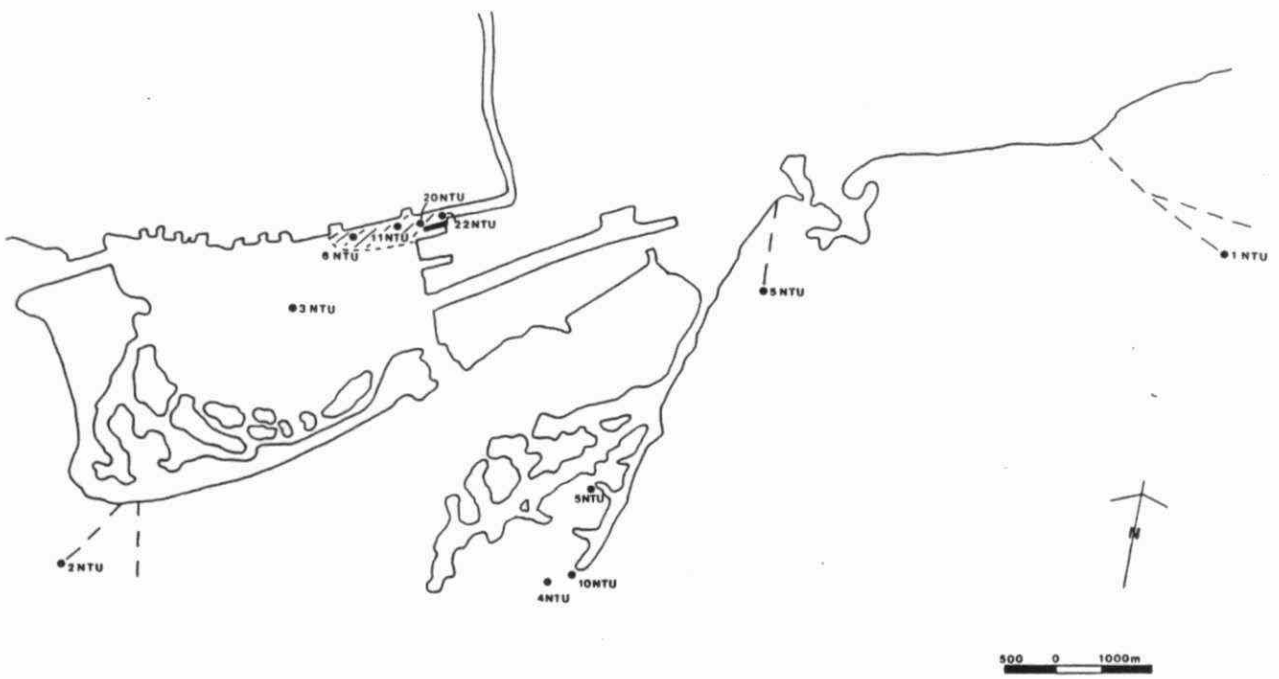


Figure 4.1.1b: Surface Turbidity During Dredging and Lakefilling
June 30, 1983

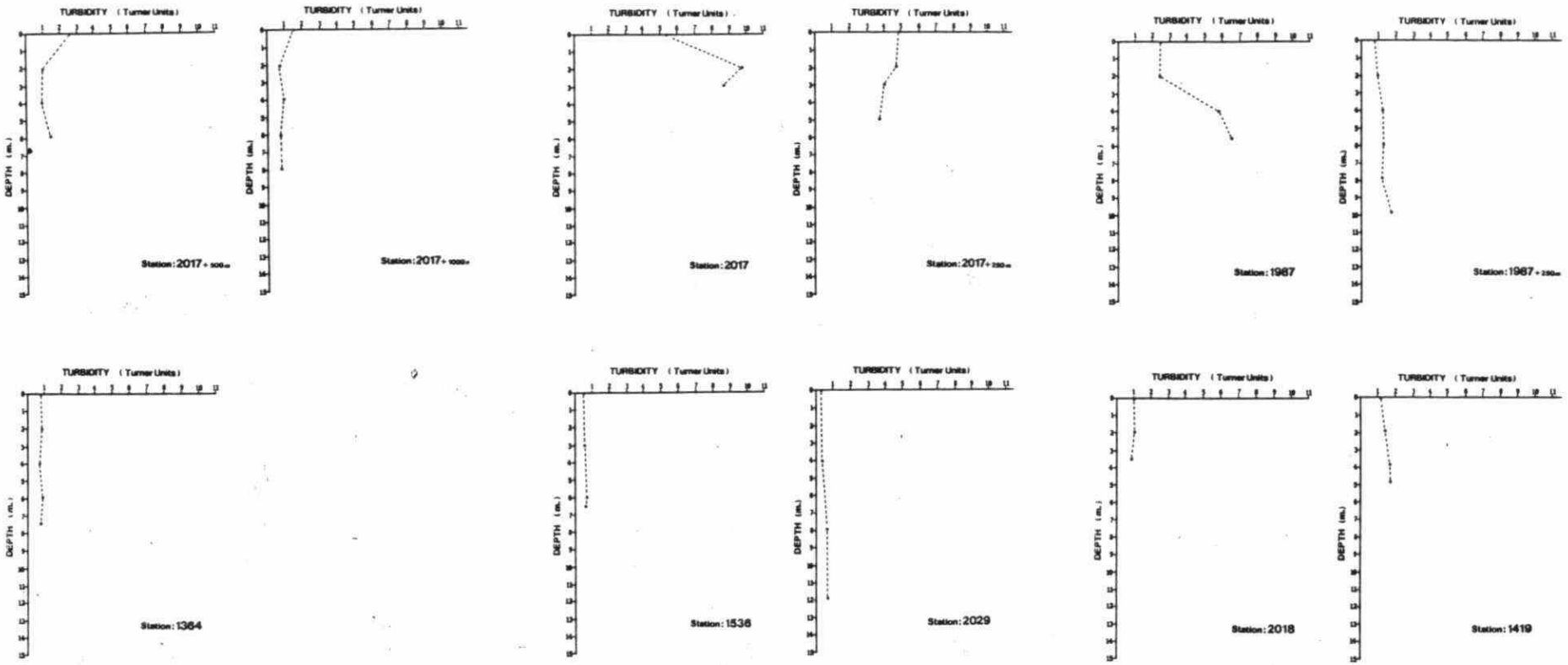


Figure 4.1.1c: Turbidity Depth Profiles June 30, 1983

4.1.2 Lakefilling

December 1, 1982:

On December 1, 1982 surface plume tracking was replaced by field observation from the survey vessel and repeated turbidity profiling along the lakefilling turbidity plume centre-line with the transmissometer giving a percentage transmission (%T) versus depth output (a high %T value indicates a low turbidity and vice versa). Surface turbidities at profiling stations were also estimated (in NTU) using the nephelometer (Figure 4.1.2a).

Surface observations and turbidity measurements demonstrated that highly elevated levels occurred only within a few metres of the active lakefilling face and that observable increases could not be distinguished at a range of more than 250 m toward the southwest.

Although surface turbidities at the lakefill site (1987) and 250 m downrange (1987+250) were low, 4.8 NTU and 4.0 NTU respectively, turbidity profiling revealed increased turbidities at depth (Figure 4.1.2b). At station 1987 the %T value remained at 52% from the surface to a depth of 3 m at which point it decreased uniformly with depth reaching minimum value of 5% at the bed depth of 8 m. At a station 250 m downrange from the lakefilling the surface turbidity was 4.0 NTU and the %T remained relatively high (approximately 60%) from surface to a depth of 8 m. A steep gradient of increasing turbidity was detected from a depth of 11 m to the bed (14 m) with the %T reaching a minimum of 5%.

In addition to stations near the East Headland, profiling and surface turbidity measurements were also performed near the Toronto Island and R.C. Harris filtration plant intakes, over the Main STP outfall, and in the Inner Harbour.

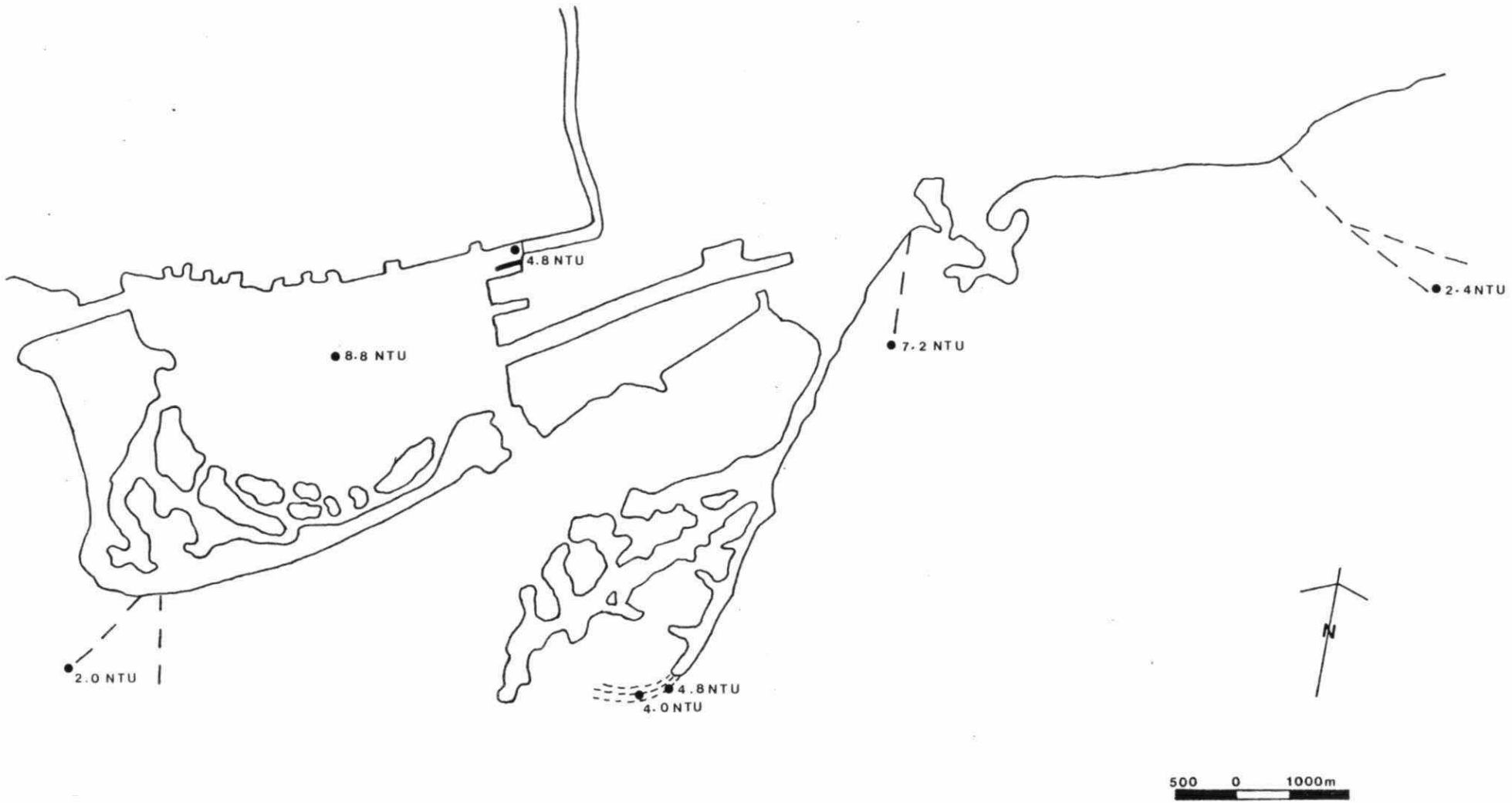


Figure 4.1.2a: Surface Turbidity During Lakefilling
December 1, 1982

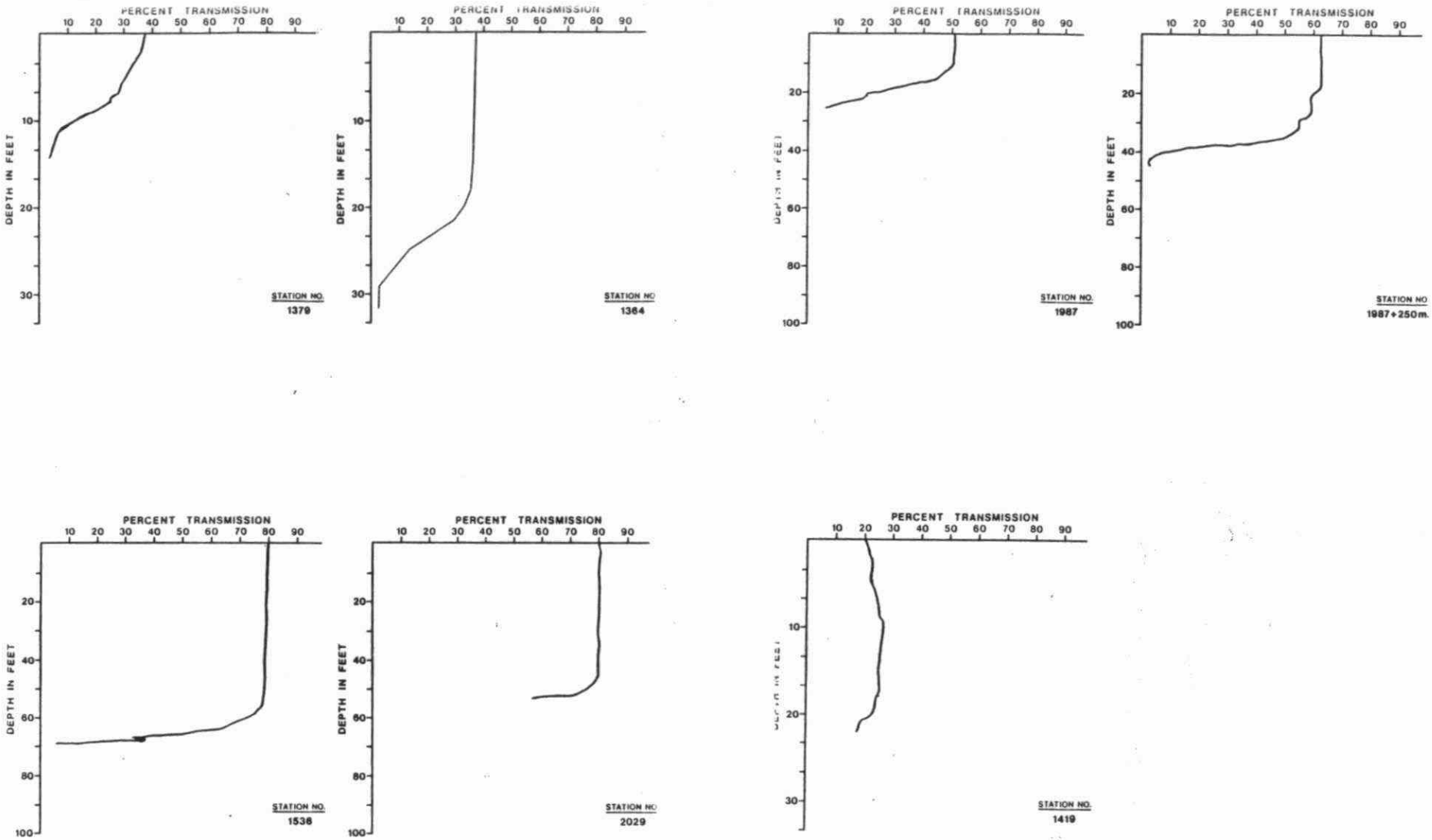


Figure 4.1.2b: Turbidity Depth Profiles December 1, 1982

A pattern similar to that detected near the headland was detected at the Island filtration plant westerly intake (1536) which had a low surface turbidity of 2.0 NTU and where a %T of greater than 75% was measured through the water column from the surface to a depth of 18m. A very steep turbidity gradient was encountered, however, from 18m to the bed at 20m with the %T decreasing to 5%. The profile obtained at the R.C. Harris filtration plant westerly intake (2029), which had a surface turbidity of 2.4 NTU, showed some increase over the bottom 3m although the minimum %T was relatively high at 57%. A uniform profile with a %T value of approximately 25% was measured at the Main STP outfall location (1419) with a surface turbidity of 7.2 NTU.

This finding implied that the steep near-bed turbidity gradient was not solely confined to the vicinity of the lakefilling activity. In the absence of temperature gradient data, however, this finding cannot be accounted for with certainty. It may have been related to surface processes as a residual effect of the moderately high winds out of the west on November 29, 1982 (where settling of resuspended fine sediments has occurred throughout the water column except for near the lake bed) or it may have been a nepheloid zone attributable to hypolimnetic currents and therefore, not directly linked to local surface conditions (Wetzel 1975). Sandilands and Mudroch (1983) have documented the presence of a nepheloid layer lake-wide in the offshore zone of Lake Ontario (in depths of greater than 60 m) with similar turbidity profiles, although its occurrence was variable and more difficult to detect at shallow stations with greater mixing and less stratification.

In the northeast corner of the Inner Harbour, just west of Cherry Street (1379), the surface turbidity was 4.8 NTU and the %T decreased steadily from 37% at the surface to less than 5% at the bed 4m below. Results for the central Inner Harbour station (1364) showed a surface turbidity of 8.8 NTU with a %T of 37% extending from the surface to a depth of 6m, followed by a uniform decrease over the next 3m to less than 5% at the bed.

The results from all stations (other than near the Main STP outfall) clearly demonstrated that subsurface elevations in turbidity occurred under these calm weather conditions in the absence of a distinct surface turbidity plume. This is of particular significance in the vicinity of the lakefilling operations where fill material may be lost to the lake unobtrusively at depth, and near the Island filtration plant intake where elevated turbidities may prevail close to the lake bed and thus near the mouth of the intake pipe (the intakes are located approximately 5 m above the lake bed at both the Toronto Island and R.C. Harris filtration plants).

April 26, 1983:

On April 26, 1983 aerial surveillance and photography were carried out to estimate the extent and direction of the surface turbidity plume in the vicinity of the lakefilling activity at the East Headland (Figure 4.1.2c). Surface turbidity measurements were made within the observed plume which indicated a narrow plume extending toward the southwest, becoming indistinct at a distance of approximately 500 m.

Turbidity profiling was conducted using the Turner nephelometer to obtain turbidity estimates on a scale from 0 to 10 units (the maximum reading of 10 Turner units corresponded to approximately 40 FTU) at 2 m or 3 m intervals throughout the water column.

On this occasion results showed fairly uniform profiles of low turbidity (within the limits of equipment and methodology) for all five stations visited (Figure 4.1.2d) indicating that under the calm weather conditions surveyed surface turbidities were generally low and characteristic of turbidity throughout the water column. There was no indication of any near-bottom turbidity gradients resulting from previous stormy conditions. This may reflect the fact that although high winds were recorded on the two days prior to the survey they were out of the northeast and north and thus would not have been responsible for

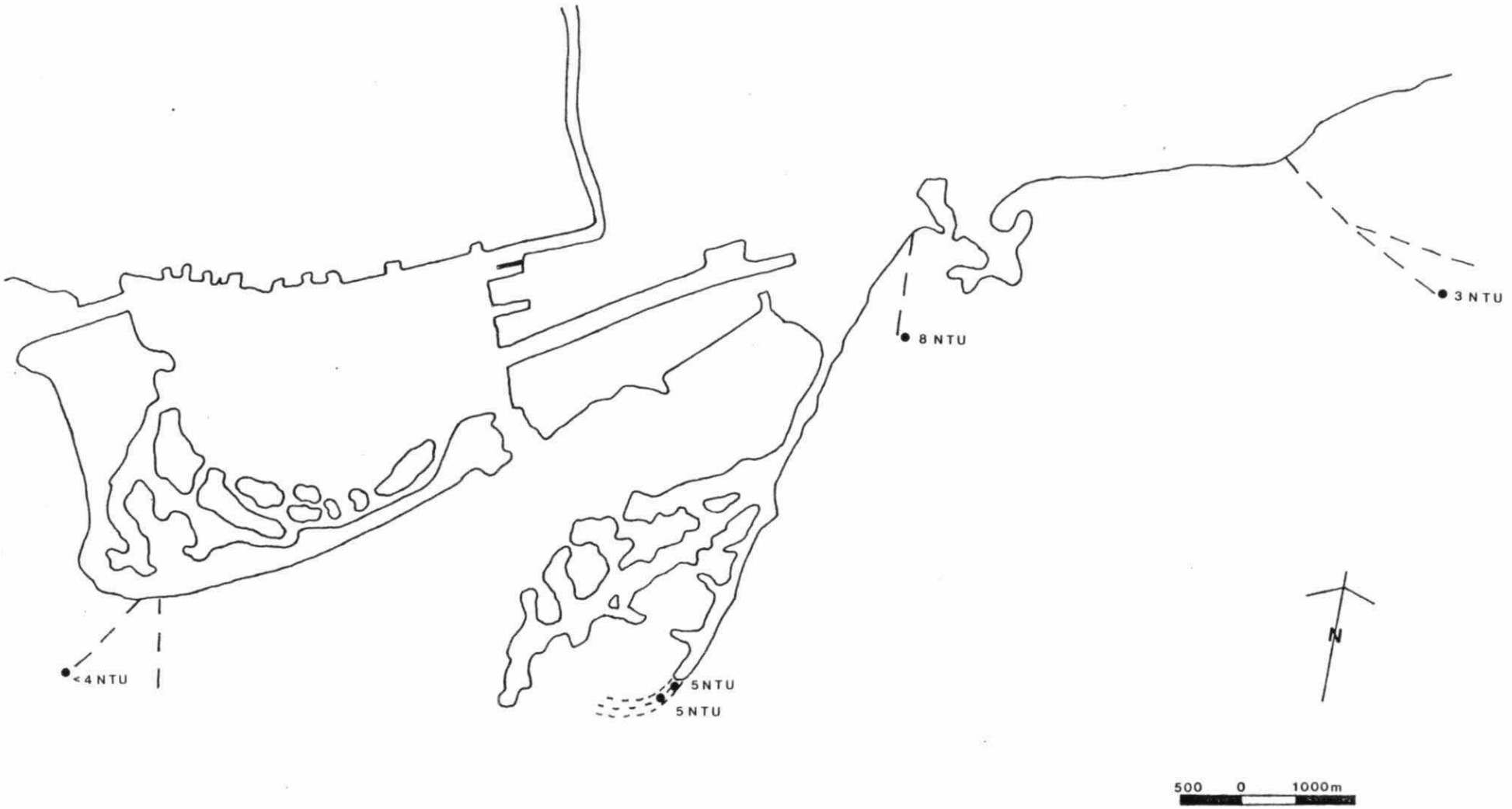
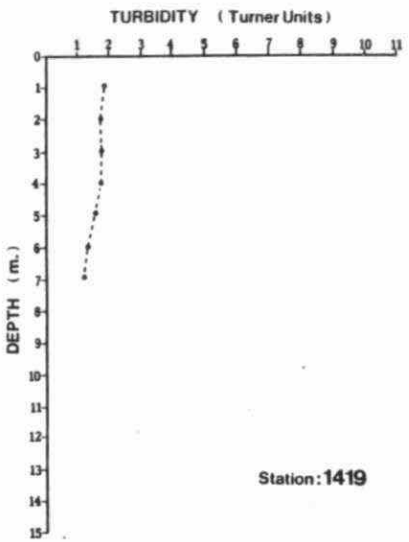
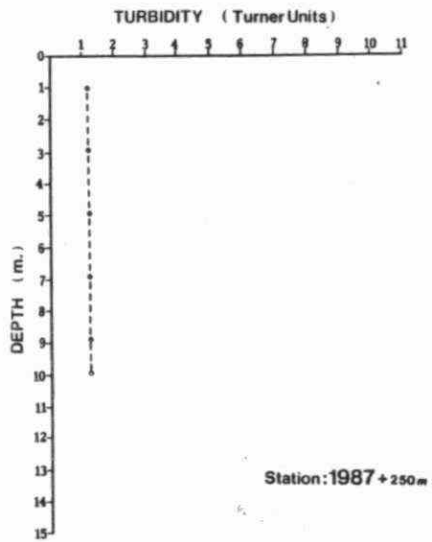
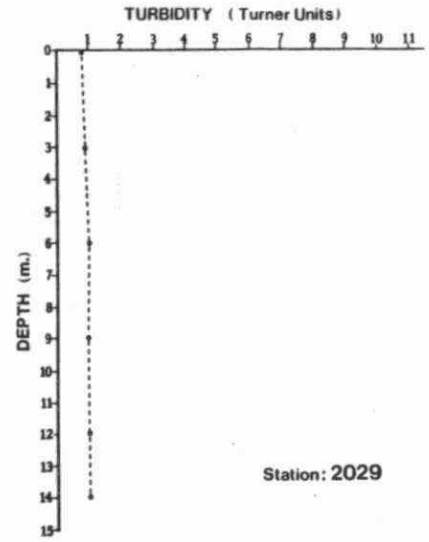
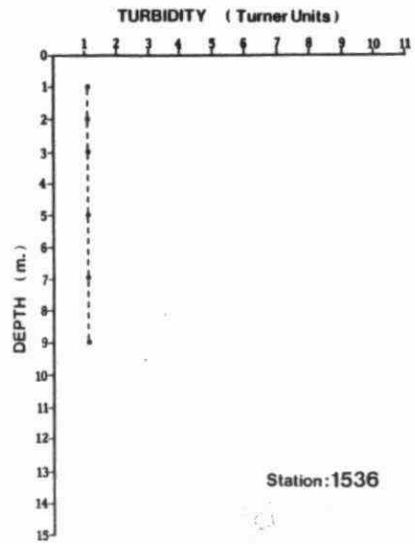


Figure 4.1.2c: Surface Turbidity During Lakefilling April 26, 1983









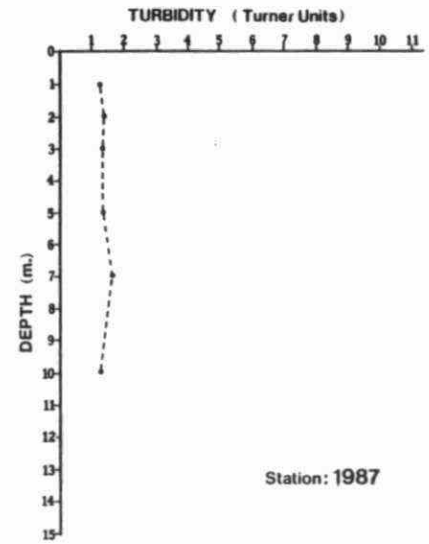


Figure 4.1.2d: Turbidity Depth Profiles April 26, 1983

wave action capable of resuspending sediments throughout the water column. Also, it is possible that the greater precision of the transmissometer profiling methodology would have been able to discern greater variability near the bed.

June 30, 1983:

Aerial surveillance on June 30, 1983 determined that there was very little surface turbidity associated with the lakefilling activity (Figure 4.1.1b). The plume extended toward the southwest but could not be readily distinguished at a range of more than 300 m.

Profile results (Figure 4.1.1c) over both the Island and R.C. Harris filtration plant intakes (1536, 2029) were similar and demonstrated a uniform distribution of low turbidity throughout the water column to the maximum available sampling depth of approximately 12 m. The profile from over the Main STP outfall (1419) exhibited a slight increase from the surface to the bed. Profiling at the lakefilling station (1987) revealed a steep gradient from a depth of 2 m to the bed (6 m) while 250 m downrange a relatively uniform profile of low turbidity was detected from the surface to the maximum available sampling depth of 12 m. However, since the total water depth at this location was approximately 14 m it is possible that elevated turbidity existed near the bed.

The results of this survey demonstrated once again that under calm conditions the subsurface turbidity at the lakefilling site exceeded the surface turbidity. It is possible that had the greater precision and depth capacity of the transmissometer been available this pattern would have been detected at other Lake Ontario stations.

4.1.3 Dredged Spoils Disposal

June 30, 1983:

Dredged spoils disposal under calm conditions was investigated once, on June 30, 1983. A surface turbidity measurement and turbidity versus depth profile were obtained at the mouth of the East Headland Cell #2 (2018) which showed uniformly low turbidity (5 NTU) throughout the water column (Figure 4.1.1b, 4.1.1c). There was no indication from water quality sampling that dredged spoils were resulting in any elevation of turbidity outside Cell #2, and aerial surveillance showed elevated turbidity to be confined to Cell #1.

4.2 Adverse Weather Surveys

4.2.1 Dredging

Opportunities for observation of dredging operations during adverse weather conditions were limited because during high wind conditions dredged spoils disposal operations were suspended for safety reasons.

September 29, 1982:

Surface plume tracking on September 29, 1982 following high precipitation (Table 3.2) indicated elevated turbidity levels of approximately 10 NTU extending approximately 750 m into the northeast corner of the Inner Harbour with a tongue extending along the harbour east wall towards the Eastern Gap (Figure 4.2.1). The harbour station (1364) was measured at 5 NTU and the station over the Toronto Island filtration plant intake (1536) was recorded as 6 NTU.

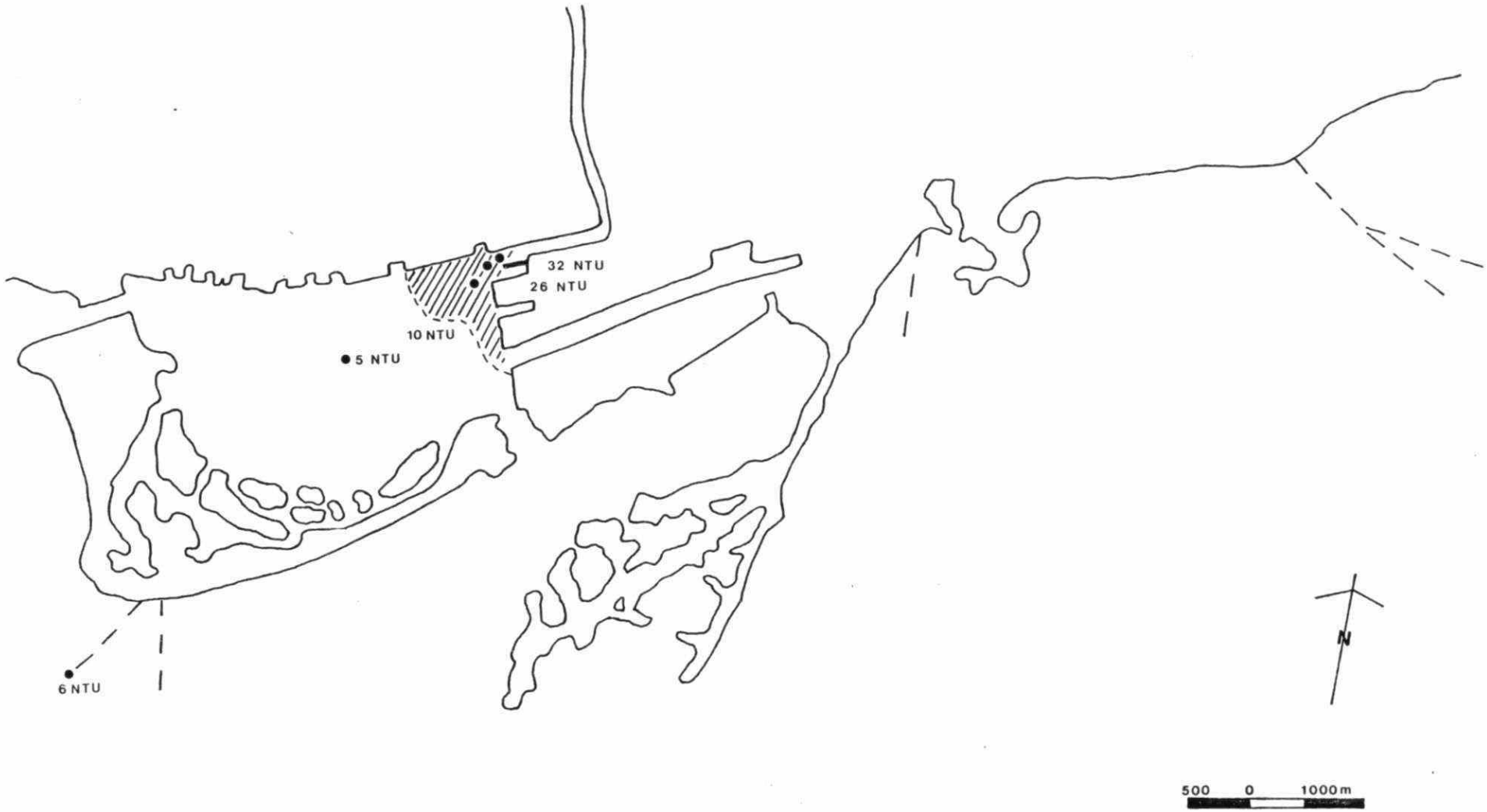


Figure 4.2.1: Surface Turbidity During Dredging September 29, 1982

A level of 32 NTU was measured next to the dredge site, diminishing to 26 NTU 100 m downstream (Figure 4.2.1). In this instance the increased flow and high turbidity levels in the Don River (as the result of the previous precipitation) appeared to be chiefly responsible for the elevated turbidity in the northeast corner of the Inner Harbour.

4.2.2 Lakefilling

Lakefilling operations were always in progress at the southernmost tip of the lakefill project on those days when it was possible for the survey vessel to operate.

September 22, 1982:

On September 22, 1982 surface turbidity plume tracking was not possible due to stormy lake conditions (Table 3.2), however observations from the survey vessel indicated a clearly defined plume originating at the lakefill site and following the prevailing currents towards the southwest. At a distance of greater than 500 m the plume could no longer be readily distinguished from the general nearshore turbidity.

In the absence of field measurements, laboratory turbidity results (in FTU) for water quality samples have been displayed (Figure 4.2.2a). These show that surface (1.5 m) turbidity levels diminished from 4.60 FTU near the lakefilling operation (1987) to 3.90 FTU at a range of 250 m, and to 2.60 FTU at a range of 500 m. Turbidities over the Toronto Island and R.C. Harris filtration plants (1536, 2029) were 1.78 FTU and 1.31 FTU respectively. The maximum turbidity level of 5.10 FTU was recorded over the Main STP outfall (1419).

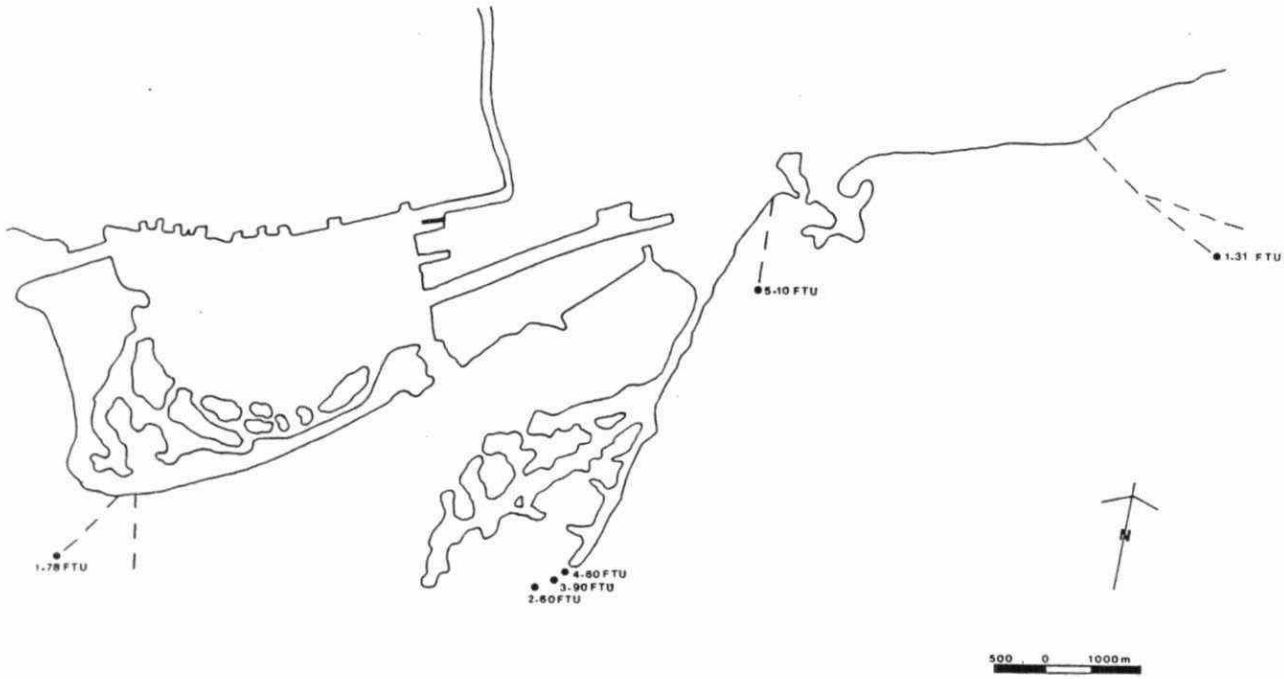


Figure 4.2.2a: Surface Turbidity During Lakefilling
September 22, 1982

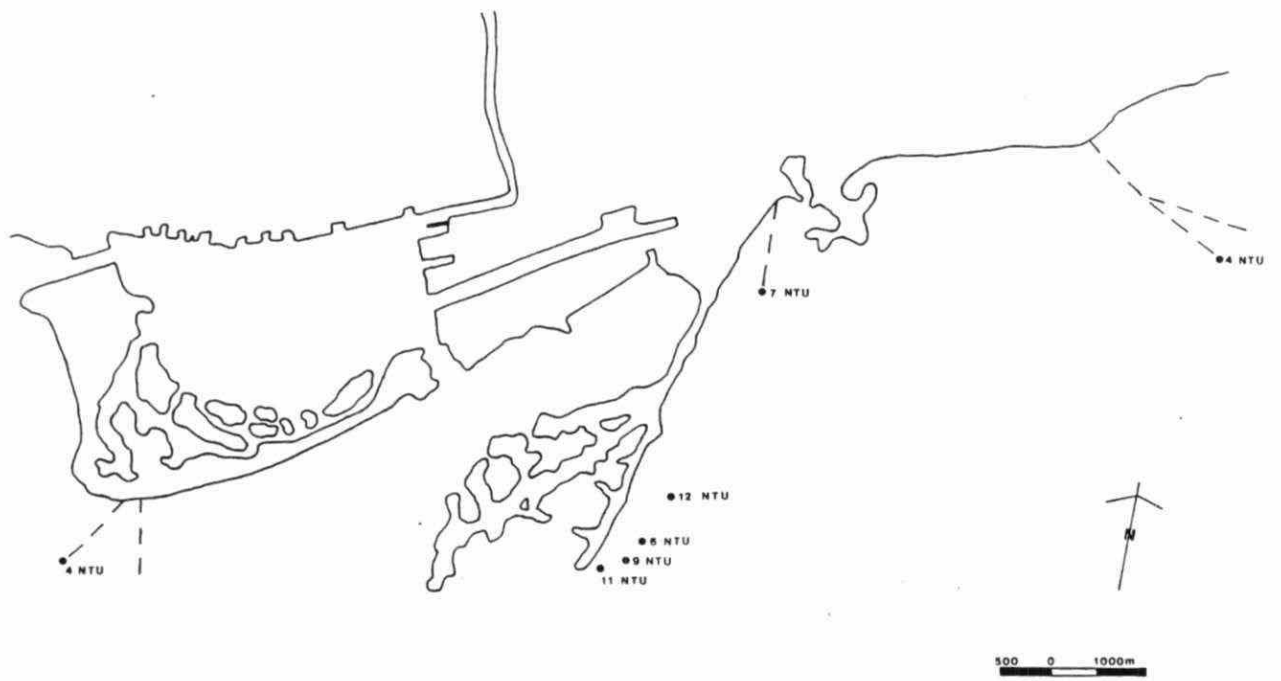


Figure 4.2.2b: Surface Turbidity During Lakefilling
October 15, 1982

October 15, 1982:

On October 15, 1982, under high wind conditions (Table 3.2) the study area was observed and photographed from the air prior to water quality sampling and turbidity depth profiling with the transmissometer along the observed centre-line. Surface turbidities were also measured using the nephelometer (Figure 4.2.2b). These observations and measurements indicated the surface plume extended with the prevailing lake currents towards the northeast for approximately 1000 m. Turbidity levels diminished from 11 NTU near the lakefilling activity, to 9 NTU 250 m downrange, and to 6 NTU 500 m downrange. At a range of 1000 m the surface turbidity was measured to be 12 NTU, possibly reflecting the residual effect of earlier lakefilling activity.

A highly significant aerial observation was the contribution of erosion from within the East Headland Cell #3 to turbidity near the lakefilling activity. Reflected and refracted waves originating from the southwest converged on the relatively unprotected interior of the new headland "arm" and were responsible for greater erosion and turbidity than at the active fill face.

Turbidity profiling (Figure 4.2.2c) revealed that high turbidity near the lakefilling site was confined to the surface layer with %T levels increasing from 25% to 70% within the top 5 m closest to the site (1987) and from 35% to 70% within the top 4 m at a range of 250 m. A submerged plume was indicated at a range of 500 m with %T decreasing from 53% at the surface to 40% at a depth of 6 m and then increasing to greater than 60% at depths of more than 10 m.

The turbidity depth profile 1000 m downrange reinforced the previous finding of high surface turbidity and revealed a uniform distribution throughout most of the water column. A %T of less than 20% was measured from the surface to a depth of approximately 9 m, with a slight increase from 9 m to the bed

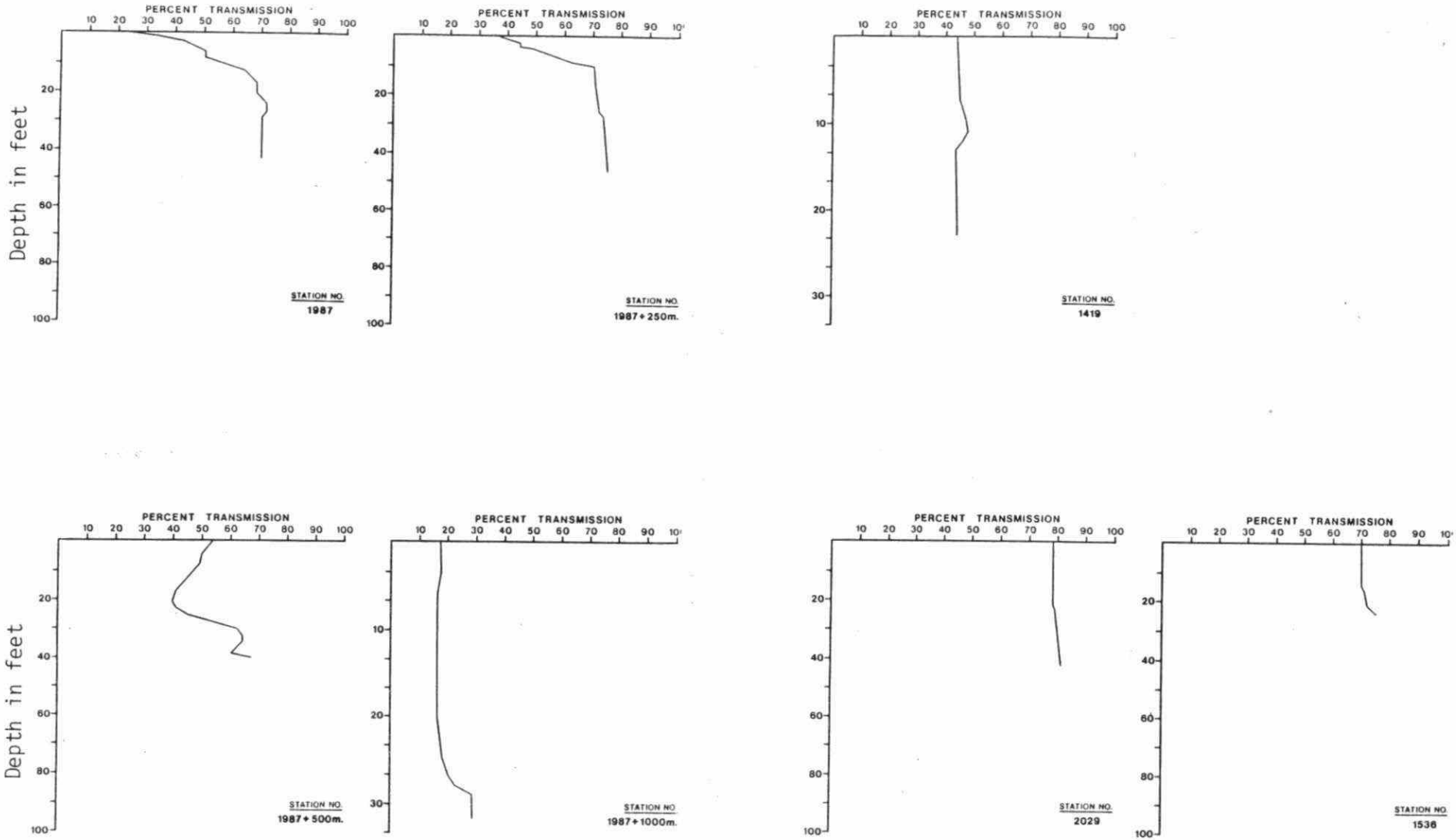


Figure 4.2.2c: Turbidity Depth Profiles October 15, 1982

(10 m). This finding suggests that a residual slug from a previous massive input of fine material was kept in suspension as the result of wave action in the relatively shallow (10 m) water.

Turbidity depth profile results from near the Toronto Island and R.C. Harris filtration plant intakes (1536, 2029) showed uniform distribution of low turbidity (%T of 70% and 78% respectively) throughout the water column with a gradual tendency for improvement from surface to bed (Figure 4.2.2c). The profile from near the Main STP outfall (1419) revealed a relatively uniform turbidity with a %T of 40-45% from surface to bed (Figure 4.2.2c).

In general, these profile results demonstrated that under high wind conditions surface turbidity was greater than subsurface turbidity near the lakefilling site and that turbidities were generally uniform throughout the water column at stations removed from the lakefilling. This differed from the calm weather findings and suggested that due to wave effects the observed surface turbidity under windy conditions was a more reasonable indicator of subsurface plume extent than surface turbidity during calm periods. However, the increase in general nearshore turbidity which accompanied high winds and waves made it difficult to track a plume from one source to any great distance on the basis of turbidity measurements.

November 5, 1982:

Aerial observation on November 5, 1982 under high wind conditions (Table 3.2) indicated widespread turbidity throughout the nearshore zone as the result of wave action. Turbidity plumes were observed originating from the old, southwesterly point of the East Headland, the Eastern Beaches, and Bluffer's Park (completed lakefill at the Scarborough Bluffs east of the study area), in addition to the active lakefilling site at the East Headland.

Field measurements using the nephelometer indicated a high surface turbidity of 22 NTU 500 m downrange from the lakefilling (Figure 4.2.2d) and turbidity depth profiling (Figure 4.2.2e) indicated that high turbidity persisted throughout the water column with %T levels varying between 10% and 20% from surface to bed. Maximum variation occurred within 5 m of the surface where wave effects were most pronounced.

No other turbidity measurements were made on November 5, 1982 since the principal objective of this survey was the collection of suspended sediment samples.

4.2.3 Dredged Spoils Disposal

Since disposal operations were suspended during high wind events, the only adverse weather condition investigated was on November 4, 1982 under moderate winds following two days of persistent precipitation (Table 3.2).

November 4,1982:

No surface plume was detected by means of aerial observation indicating the loss of material from the disposal basin (East Headland Cell #1). The surface turbidity within the disposal basin (1989) was determined to be high at 37 NTU, while that near the mouth of East Headland Cell #2 (2018) was measured at 7 NTU. Resuspension of material and erosion within East Headland Cell #2 and #3 appeared to be chiefly responsible for any slight elevations in surface turbidity.

Turbidity depth profiles at both stations 1989 and 2018 demonstrated that surface turbidity was indicative of subsurface conditions (Figure 4.2.3b). A %T of 8% was recorded over the

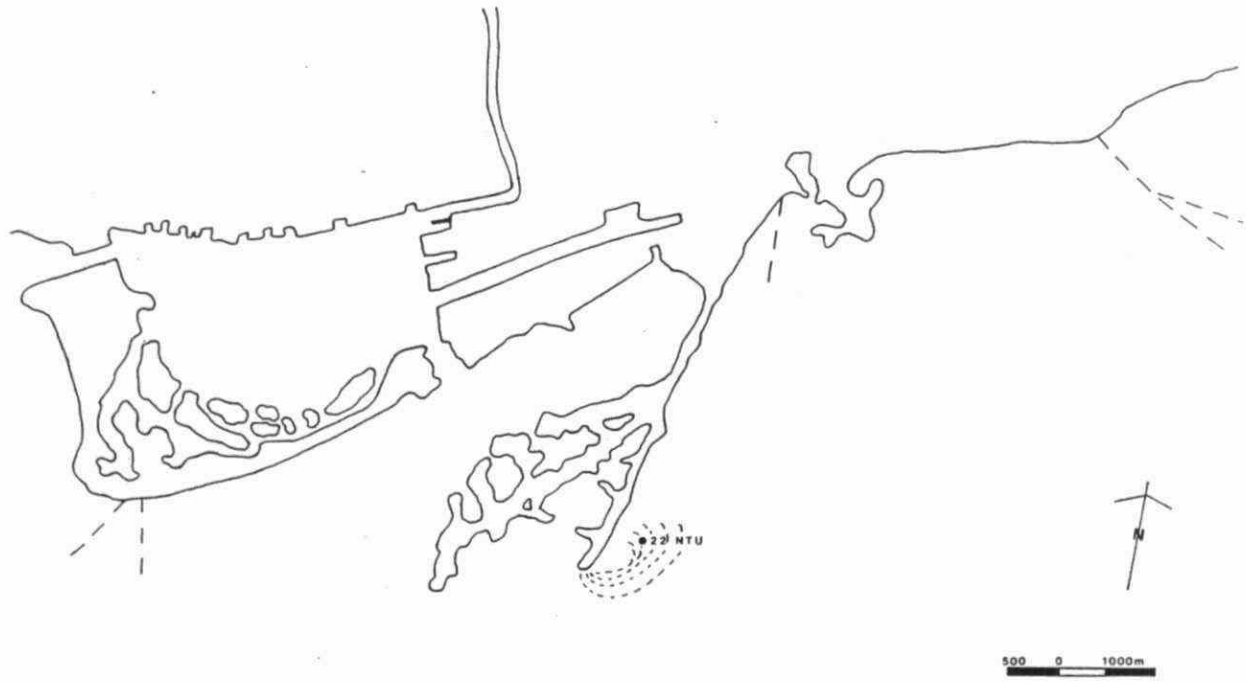


Figure 4.2.2d: Surface Turbidity During Lakefilling
November 5, 1982

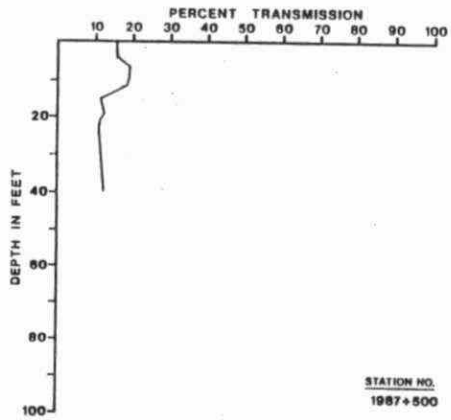


Figure 4.2.2e: Turbidity Depth Profile November 5, 1982

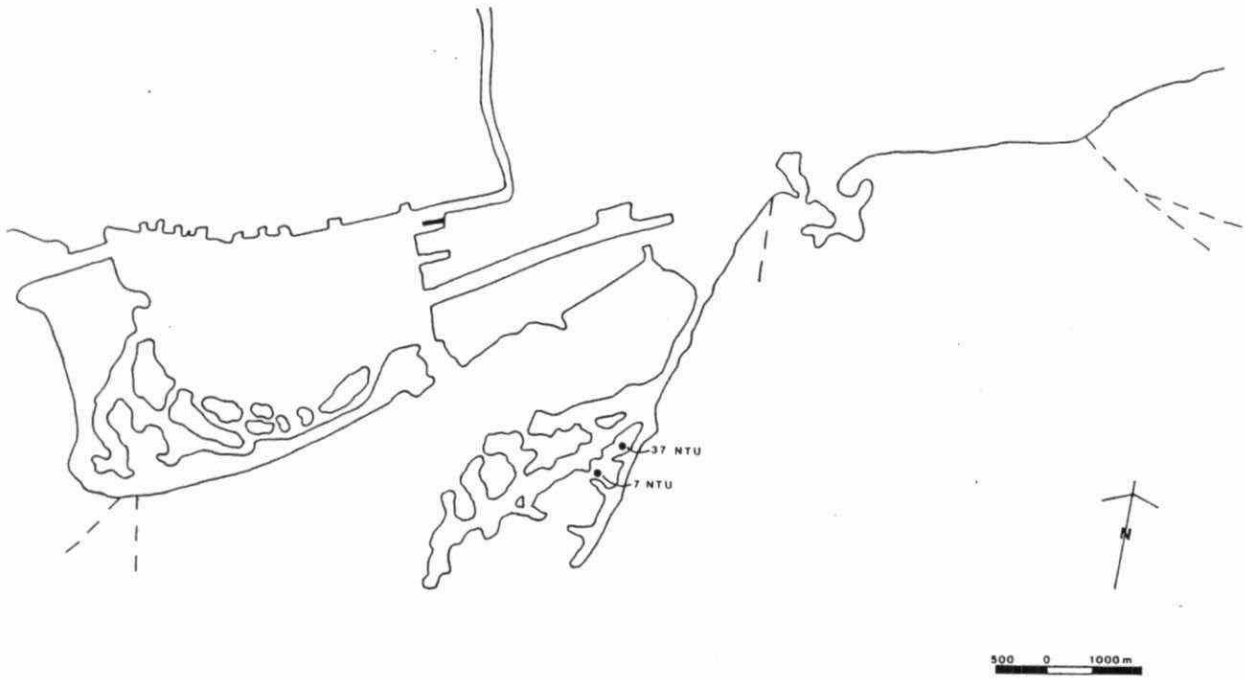


Figure 4.2.3a: Surface Turbidity During Dredged Spoils Disposal
November 4, 1982

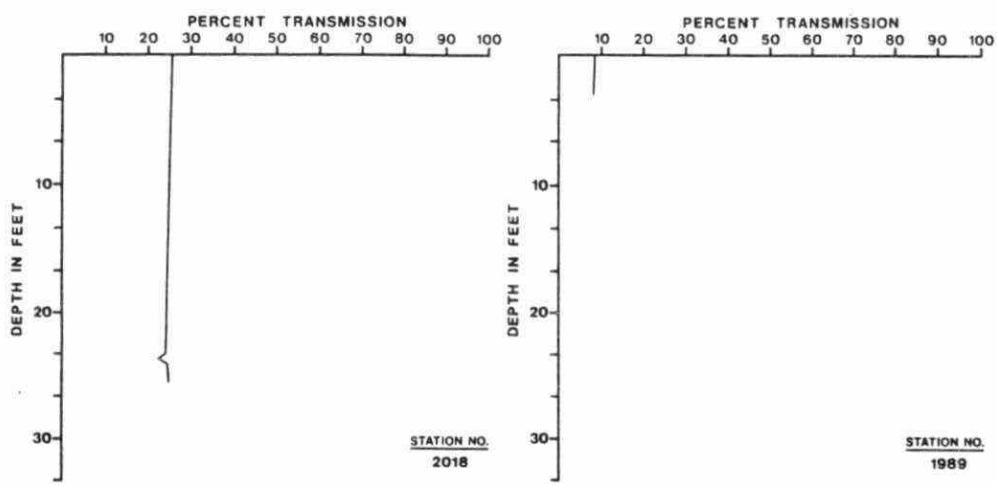


Figure 4.2.3b: Turbidity Depth Profiles November 4, 1982

extremely shallow water column within the disposal basin (1989) and a %T of 25% was measure at all depths for the mouth of East Headland Cell #2 (2018). There was no indication that material was migrating toward the lake at depth.

No other stations were sampled on this survey day since centrifuging of suspended particles was the principal objective.

5. PHYSICAL TESTS AND NUTRIENTS RESULTS

Single sample conductivity ($25^{o}C$), turbidity, suspended solids, total phosphorus, and total Kjeldahl nitrogen results for calm and adverse weather conditions have been selected for presentation on a survey-by-survey basis (Tables 5.1 and 5.2). These have been used to assess qualitatively the potential effects of dredging and lakefilling activities; single sample results did not permit a quantitative assessment of significant differences. Additional results are listed in Appendix A2.

The laboratory turbidity results have been included here since they were of greater precision than the field estimates. A strong positive linear correlation ($r = 0.91$, significant at the 99% level) was determined between concentrations of suspended solids and laboratory turbidity, although in the absence of particle size data there was no basis for predicting a quantitative relation between turbidity and concentrations of other parameters.

5.1 Calm Weather Surveys

5.1.1 Dredging

September 21, 1982:

The September 21, 1982 survey provided the best coverage of dredging under calm weather conditions although some results were obtained on June 30, 1983. In addition a set of samples was taken at the Cherry Street bridge (Figure 1.1) on December 1, 1982 when no dredging was in progress in the northeast corner of the Inner Harbour.

Dredging activity was considered to have had a potential effect on water quality if levels of a particular parameter near the dredge (2017) exceeded those detected upstream in the Don River

TABLE 5.1 SELECTED PHYSICAL TESTS AND NUTRIENTS FOR CALM WEATHER SURVEYS

PARAMETER	DATE	STATIONS														
		Don R.	Cherry Street	Dredge	Dredge +100m	Dredge +250m	Inner Harb.	Island Intake	Island Plant	Cell#2 Mouth	L.Fill	L.Fill +250m	M. STP Plant	M. STP Inlake	Harris Inlake	Harris Plant
		2020	1379	2017			1364	1536	Raw	2018	1987		Final	1419	2029	Raw
TURBIDITY FTU	21/09/82	6.10	--	10.20	6.40	1.81	3.50	1.01	0.89	--	--	--	6.80	3.70	1.07	1.80
	01/12/82	--	3.30	--	--	--	4.80	1.24	--	--	2.90	2.80	25 00	6.20	1.08	5.80
	26/04/83	--	--	--	--	--	--	1.40	--	--	7.40	--	--	5.90	1.10	--
	30/06/83	--	--	--	--	--	2.40	1.20	--	6.50	60.00	--	--	--	7.50	--
SUSPENDED mg/l	21/09/82	10.60	--	20.80	7.35	3.29	2.84	1.73	--	--	--	--	13.00	3.57	1.28	1.18
	26/04/83	--	--	--	--	--	--	1.59	--	--	10.90	--	--	12.90	2.01	--
	30/06/83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CONDUCT. 25° uS/cm	21/09/82	341	--	592	393	347	355	323	320	--	--	--	880	389	325	328
	01/12/82	--	393	--	--	--	392	327	--	--	341	336	1030	373	329	332
	26/04/83	--	--	--	--	--	--	320	--	--	343	--	--	643	322	--
	30/06/83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL P ug/l	21/09/82	260*	--	99*	70*	28*	34*	22*	10	--	--	--	980*	83*	14	22*
	01/12/82	--	35*	--	--	--	36*	7	--	--	38*	19	773*	67*	13	83*
	26/04/83	--	--	--	--	--	--	15	--	--	31*	--	--	275*	14	--
	30/06/83	--	--	115*	--	--	36*	11	--	17	104*	--	--	--	20	--
TOTAL KJELDAL N mg/l	21/09/82	4.50	--	2.25	1.19	0.44	0.52	0.33	0.19	--	--	--	21.00	3.40	0.25	0.26
	01/12/82	--	0.59	--	--	--	0.53	0.20	--	--	0.55	0.28	--	1.44	0.22	0.43
	26/04/83	--	--	--	--	--	--	0.23	--	--	0.64	--	--	--	0.28	--
	30/06/83	--	--	0.62	--	--	0.49	0.30	--	0.33	0.42	--	--	--	0.37	--

"*" Indicates a concentration in exceedance of the Provincial Water Quality Objective or Guideline for the protection of aquatic life and recreation
"--" Indicates no result available

TABLE 5.2 SELECTED PHYSICAL TESTS AND NUTRIENTS FOR ADVERSE WEATHER SURVEYS

		STATIONS															
		Don R. 2020	Dredge 2017	Dredge +100m	Dredge +250m	Inner Harb. 1364	Island Intake 1536	Cell#1 1989	Cell#2 Mouth 2018	L.Fill 1987	L.Fill +100m	L.Fill +250m	L.Fill +500m	L.Fill +1000m	M. STP Plant Final	M. STP Inlake 1419	Harris Inlake 2029
	22/09/82	--	--	--	--	--	1.78	--	--	4.60	3.90	2.60	--	--	--	5.10	1.31
TURBIDITY	29/09/82	16.80	32.00	25.0	4.40	2.10	2.30	--	--	--	--	--	--	--	--	--	--
FTU	15/10/82	--	--	--	--	--	1.93	--	--	10.40	--	6.40	3.60	10.50	7.90	4.70	1.22
	04/11/82	--	--	--	--	--	--	29.00	3.20	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	24.00	--	--	--	--
SUSPENDED	22/09/82	--	--	--	--	--	1.62	--	--	8.28	5.75	5.57	--	--	--	5.79	A0.40
SOLIDS	29/09/82	17.90	36.50	21.80	3.05	1.81	3.07	--	--	--	--	--	--	--	--	--	--
mg/l	15/10/82	--	--	--	--	--	1.20	--	--	2.58	--	5.35	4.00	12.30	11.60	5.49	2.62
	04/11/82	--	--	--	--	--	--	41.30	8.30	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CONDUCT.	22/09/82	--	--	--	--	--	334	--	--	335	339	334	--	--	--	343	322
25°	20/09/82	879	634	539	347	322	322	--	--	--	--	--	--	--	--	--	--
uS/cm	15/10/82	--	--	--	--	--	320	--	--	325	--	324	325	324	931	346	323
	04/11/82	--	--	--	--	--	--	333	330	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	328	--	--	--	--
TOTAL	22/09/82	--	--	--	--	--	18	--	--	32*	35*	28*	--	--	--	190*	21*
P	29/09/82	135*	145*	100*	31*	26*	28*	--	--	--	--	--	--	--	--	--	--
ug/l	15/10/82	--	--	--	--	--	15	--	--	25*	--	19	14	14	2900*	110*	11
	04/11/82	--	--	--	--	--	--	--	17	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	55*	--	--	--	--
TOTAL	22/09/82	--	--	--	--	--	0.32	--	--	0.63	0.66	0.65	--	--	--	2.00	0.31
KJELDAHL N	29/09/82	2.75	2.12	1.48	0.53	0.37	0.40	--	--	--	--	--	--	--	--	--	--
mg/l	15/10/82	--	--	--	--	--	0.27	--	--	0.23	--	0.22	0.21	0.20	20.50	3.80	0.22
	04/11/82	--	--	--	--	--	--	--	0.29	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	0.25	--	--	--	--

"A" indicates an approximate result
"*" indicates a concentration in exceedance of the Provincial Water Quality Objective or Guideline
"--" indicates no result available

south of Eastern Avenue (station 2020, approximately 300 m north of Front St.), although the potential effects of the numerous sewer inputs throughout the lower Don (13 are shown on the City of Toronto Department of Public Works sewer map dated August 1983) make this assessment difficult to quantify.

Applying this criterion to the parameters listed in Table 5.1 for September 21, 1982 reveals that turbidity, suspended solids, and conductivity were potentially effected by dredging activity since all increased from the upstream location to the dredge site. This effect was localized, however, since levels for these parameters decreased to below the upstream levels within 250 m downrange from the dredge site (except for conductivity where the Inner Harbour level remained higher than that in the Don River). The localized nature of these increases concurred with the observed confinement of the river plume in the northeast corner of the Inner Harbour on September 21, 1982.

December 1, 1982:

Results for December 1, 1982 demonstrated that when no dredging was in progress, central Inner Harbour turbidity levels were slightly higher than in the northeast corner at Cherry Street (1379) and that conductivities were virtually identical. This was not the case during dredging on September 21 and supports the observation that dredging contributed to localized increases in levels of some physical parameters.

5.1.2 Lakefilling

Due to weather constraints on safe operation of the survey vessel, there was no opportunity to sample when lakefilling was not in progress at the lakeward tip of the East Headland.

December 1, 1982:

For the open lake stations on December 1, 1982 the receiving water over the Main STP outfall (1419) displayed the highest levels for all parameters (Table 5.1) with the lakefilling station (1987) and 250 m downrange from the lakefilling ranking second and third, respectively. The provincial guideline for total phosphorus of 20 ug/l was exceeded over the Main STP outfall (67 ug/l) and near the lakefilling site (38 ug/l).

Parameter levels 250 m downrange from the lakefilling were generally lower than those in the immediate vicinity of the lakefilling, and results from over the Island filtration plant intake (1536) were similar to (or lower than) those over the R.C. Harris filtration plant intake (2029). This suggests that surface water effects of lakefilling and inputs from the Main STP were highly localized, however, surface water quality results may not have typified subsurface conditions due to the existence of subsurface plumes.

April 26, 1983:

The survey on April 26 (and June 30) 1983 incorporated sampling from the depth of greatest turbidity in order to maximize the likelihood of contaminant detection. These results, however, cannot be compared directly to those from previous surveys.

Turbidity profiling for April 26, 1983 showed no marked subsurface increases so sampling depths of greatest turbidity were chosen arbitrarily. Samples over the Island and R.C. Harris filtration plant intakes were taken at 1.5 m and 12 m (the maximum depth possible with the available equipment) respectively, as well as near the lake bed (7 m) at the lakefilling site, and 1 m below the surface over the Main STP outfall.

Results (Table 5.1) show that the 1 m depth sample from over the Main STP outfall (1419) exhibited greater levels for conductivity, total phosphorus, and total Kjeldahl nitrogen than the sample from near the bed at the lakefilling site (1987) but that turbidity and suspended solids were similar at both locations. Total phosphorus levels exceeded 20 ug/l over the Main STP outfall (275 ug/l) and near the lakefilling site (31 ug/l).

The samples from over the Island and R.C. Harris filtration plant intakes (1536, 2029) showed greatly diminished levels for all parameters (Table 5.1), with levels similar to those found previously in surface samples from these locations, and demonstrated no effects of either lakefilling activities or inputs from the Main STP. It is possible, however, that increased turbidity and associated elevations in levels of some parameters may have existed near the bed below the maximum profiling and sampling range of 12 m.

June 30, 1983:

Results for June 30, 1983 indicated that turbidity levels measured at a depth of 12 m over the R.C. Harris filtration plant intake were high relative to previous surface and subsurface sample results at this location and relative to the Island filtration plant intake results. Slight elevations in total phosphorus and total Kjeldahl nitrogen accompanied the elevated subsurface turbidity although these cannot be directly attributed to lakefilling activity and inputs from the Main STP since the observed surface currents were flowing from east to west.

5.1.3 Dredged Spoils Disposal

June 30, 1983:

The June 30, 1983 survey included sampling at the mouth of the East Headland Cell #2 (Table 5.1: station 2018) to assess the loss to the open lake of any material from Cell #1 where dredged spoils were deposited.

Aerial observation indicated that any turbidity and associated water quality degradation at the mouth of Cell #2 was chiefly the result of erosion and resuspension from the interior of the East Headland "arm". Samples taken at 3.5 m, the depth of greatest turbidity, revealed total phosphorus and turbidity levels far less than those found at the lakefilling site although still greater than those detected near the Island filtration plant intake. Total Kjeldahl nitrogen levels were similar to those at the filtration plant intake.

5.2 Adverse Weather Surveys

5.2.1 Dredging

September 29, 1982:

The September 29, 1982 survey following heavy precipitation (see Table 3.2) provided the only coverage of dredging under adverse weather conditions because operations were suspended during high winds. As with the calm weather surveys, dredging was considered to have had a potential effect on water quality when parameter levels at the dredge site exceeded those measured upstream in the Don River (2020).

Application of this criterion to the parameters listed in Table 5.2 shows that turbidity, suspended solids, and total phosphorus were potentially affected although the increase in phosphorus was not large enough to be considered significant on the basis of a single sample. As with calm weather these increases were localized being confined chiefly to within 100 m downstream of the dredge although in this case storm runoff to the lower Don River between the northeast corner of the Inner Harbour and the sampling location in the Don River south of Eastern Avenue may have been at least partially responsible.

5.2.2 Lakefilling

Lakefilling oriented surveys were carried out under adverse weather conditions on September 22, October 15, and November 5, 1982 (see Table 3.2 for summary of environmental conditions).

September 22, 1982:

On September 22, 1982 during moderately high easterly winds with currents toward the southwest, sampling at Lake Ontario stations showed that the receiving water over the Main STP outfall (1419)

exhibited the highest levels for all parameters in Table 5.2 except suspended solids. Stations near the lakefilling were generally next highest, followed by those 250 m downrange. In particular, total phosphorus and total Kjeldahl nitrogen levels over the STP outfall greatly exceeded results from stations near the lakefilling indicating that the STP was the prime source of nutrients.

Slightly higher surface turbidity, suspended solids, and conductivity levels were detected over the Toronto Island filtration plant intake than over the R.C. Harris filtration plant intake which may have been related to a combination of current direction and the cumulative effect of inputs between the two intakes. However, with the exception of conductivity, levels of all parameters in Table 5.2 were greatly diminished over the Toronto Island filtration plant intake in comparison to the vicinity of the lakefilling activity illustrating the localized nature of surface water effects from lakefilling and the Main STP. Total phosphorus exceeded the provincial guideline of 20 ug/l for the maintenance of nuisance free lake conditions over the Main STP outfall (190 ug/l), and near the lakefilling site (32 ug/l).

These results were similar to the calm weather observations, however since no turbidity depth profiling was performed there was no means of verifying that surface conditions were typical of subsurface conditions.

October 15, 1982:

On October 15, 1982 during high winds from the NW and currents towards the northeast (see Table 3.2) total phosphorus and total Kjeldahl nitrogen levels over the Main STP outfall (1419) again greatly exceeded those found near the lakefilling site. Levels at both locations exceeded the provincial phosphorus objective of 20 ug/l with 190 ug/l measured over the Main STP outfall and 25 ug/l near the lakefilling site (Table 5.2).

Laboratory turbidity and suspended solids results reflected the field turbidity observations (as discussed in Section 4.2) with the station 1000 m downrange from the lakefilling exhibiting a similar turbidity level to that measured near the lakefill (1987) and a suspended solids concentration far greater than at the lakefilling station (Table 5.2). The suspended solids results showed higher concentrations downrange in the plume than at the supposed source: the lakefilling activity. This suggests that in relatively shallow water (approximately 10 m), wave action and a variable input of material combine so that no clear gradient of suspended solids concentrations from a "point" source (such as the lakefilling) can be detected.

November 5, 1982:

One station was sampled 500 m downrange from the lakefilling on November 5, 1982 during high winds from the WNW and currents towards the NE (Table 3.2). A high surface turbidity of 24 FTU was measured as was a total phosphorus level of 55 ug/l (Table 5.2).

5.2.3 Dredged Spoils Disposal

November 4, 1982:

The November 4, 1982 survey sampled solely at the East Headland Cell #1 (station 1989, the active disposal cell) and at the mouth of Cell #2 (2018) following prolonged precipitation but during light winds (Table 3.2).

No total phosphorus or total Kjeldahl nitrogen results were available for Cell #1 although results at the mouth of Cell #2 showed values similar to those from near the Toronto Island filtration plant intake. Total phosphorus was below the 20 ug/l Provincial guideline at a level of 17 ug/l. Although turbidity and suspended solids levels (Table 5.2) were extremely elevated

within Cell #1 (29 FTU and 41.3 mg/l respectively) they were greatly diminished at the mouth of Cell #2 where they appeared to be primarily the result of erosion and resuspension from within Cell #2 itself.

6. HEAVY METALS RESULTS

Heavy metals sampling was performed at the same time as the previously discussed physical and nutrient parameters. Single sample cadmium, copper, chromium, lead, nickel, and zinc results for calm and adverse weather conditions have been presented on a survey-by-survey basis (Tables 6.1 and 6.2) and have been used to assess qualitatively the potential effects of dredging and lakefilling activities. The quantitative significance of observed differences could not be determined on the basis of single samples. Additional results are listed in Appendix A3.

6.1 Calm Weather Surveys

6.1.1 Dredging

September 21, 1982:

Localized increases in turbidity and suspended solids levels near the dredge site on September 21, 1982 (Section 5.1.1) were accompanied by small localized increases in copper and and zinc although the increases were not large enough to be considered significant on the basis of this single sample. Copper exceeded the 5 ug/l Provincial Water Quality Objective for the protection of aquatic life and recreation (PWQO) at the Don River location (9 ug/l), the dredge site (13 ug/l), and 100 m downrange from the dredge site (8 ug/l).

December 1, 1982:

On December 1, 1982 (when no dredging was taking place), levels of all metals (Table 6.1) at the Cherry Street bridge (northeast corner of the Inner Harbour) were less than or similar to those in the central Inner Harbour.

TABLE 6.1 SELECTED METALS RESULTS FOR CALM WEATHER SURVEYS

PARAMETER	DATE	STATIONS														
		Don R.	Cherry Street	Dredge	Dredge +100m	Dredge +250m	Inner Harb.	Island Intake	Island Plant	Cell#2 Mouth	L.Fill	L.Fill +250m	M. STP Plant	M. STP Inlake	Harris Inlake	Harris Plant
		2020	1379	2017			1364	1536	Raw	2018	1987		Final	1419	2029	Raw
Cd ug/l	21/09/82	ND	--	ND	ND	ND	ND	ND	ND	--	--	--	0.4*	ND	ND	--
	01/12/82	--	ND	--	--	--	ND	ND	--	--	ND	ND	10.0*	ND	ND	ND
	26/04/83	--	--	--	--	--	--	0.3*	--	--	0.5*	--	--	7.0*	0.3*	--
	30/06/83	--	--	0.5*	--	--	0.3*	0.5*	--	0.3*	0.4*	--	--	0.4*	0.3*	--
Cu ug/l	21/09/82	9*	--	13*	8*	5	4	4	19*	--	--	--	250	6	4	--
	01/12/82	--	7*	--	--	--	10*	6*	--	--	5	6*	530*	7*	6*	30*
	26/04/83	--	--	--	--	--	--	7*	--	--	100*	--	--	30*	6*	--
	30/06/83	--	--	14*	--	--	7*	7*	--	6*	10*	--	--	8*	7*	--
Cr ug/l	21/09/82	5	--	5	2	2	1	2	ND	--	--	--	20	5	1	--
	01/12/82	--	3	--	--	--	2	2	--	--	3	3	30	5	6	4
	26/04/83	--	--	--	--	--	--	ND	--	--	5	--	--	4	ND	--
	30/06/83	--	--	5	--	--	87	14	--	5	5	--	--	13	1	--
Pb ug/l	21/09/82	ND	--	3	ND	4	ND	4	ND	--	--	--	20	ND	ND	--
	01/12/82	--	ND	--	--	--	3	ND	--	--	4	ND	25	ND	ND	5
	26/04/83	--	--	--	--	--	--	ND	--	--	6	--	--	9	ND	--
	30/06/83	--	--	20	--	--	5	7	--	4	12	--	--	4	6	--
Ni ug/l	21/09/82	5	--	2	5	2	1	1	ND	--	--	--	40*	7	1	--
	01/12/82	--	4	--	--	--	4	2	--	--	3	3	35*	6	2	3
	26/04/83	--	--	--	--	--	--	2	--	--	11	--	--	6	2	--
	30/06/83	--	--	5	--	--	2	3	--	3	6	--	--	5	--	--
Zn ug/l	21/09/82	10	--	15	4	3	3	2	4	--	--	--	36*	5	2	--
	01/12/82	--	6	--	--	--	9	3	--	--	4	2	49*	4	2	18
	26/04/83	--	--	--	--	--	--	6	--	--	78*	--	--	87*	3	--
	30/06/83	--	--	38*	--	--	3	1	--	2	13	--	--	4	3	--

"*" Indicates a concentration in exceedance of the Provincial Water Quality Objective or Guideline for the protection of aquatic life and recreation
"--" Indicates no result available
"ND" indicates not detected

TABLE 6.2 SELECTED METALS RESULTS FOR ADVERSE WEATHER SURVEYS

		STATIONS															
		Don R. 2020	Dredge 2017	Dredge +100m	Dredge +250m	Inner Harb. 1364	Island Intake 1536	Cell#1 1989	Cell#2 Mouth 2018	L.Fill 1987	L.Fill +100m	L.Fill +250m	L.Fill +500m	L.Fill +1000m	M. STP Plant Final	M. STP Inlake 1419	Harris Inlake 2029
Cd	22/09/82	--	--	--	--	--	ND	--	--	--	18.0*	ND	--	--	--	0.2	ND
ug/l	29/09/82	0.4*	ND	ND	0.2	ND	ND	--	--	--	--	--	--	--	--	--	--
	15/10/82	--	--	--	--	--	ND	--	--	ND	--	0.2	ND	ND	0.6*	ND	ND
	04/11/82	--	--	--	--	--	--	ND	ND	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	ND	--	--	--	--
Cu	22/09/82	--	--	--	--	--	4	--	--	--	4	4	--	--	--	9*	3
ug/l	29/09/82	50*	10*	8*	5	8*	8*	--	--	--	--	--	--	--	--	--	--
	15/10/82	--	--	--	--	--	ND	--	--	2	--	ND	ND	ND	170	ND	2
	04/11/82	--	--	--	--	--	--	9*	6*	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	5	--	--	--	--
Cr	22/09/82	--	--	--	--	--	ND	--	--	--	2	3	--	--	--	8	1
ug/l	20/09/82	12	29	29	2	1	1	--	--	--	--	--	--	--	--	--	--
	15/10/82	--	--	--	--	--	9	--	--	7	--	9	12	8	160*	11	25
	04/11/82	--	--	--	--	--	--	3	2	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--
Pb	22/09/82	--	--	--	--	--	4	--	--	--	ND	ND	--	--	--	5	ND
ug/l	29/09/82	14	6	6	3	3	6	--	--	--	--	--	--	--	--	--	--
	15/10/82	--	--	--	--	--	6	--	--	--	5	6	4	6	14	5	4
	04/11/82	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	ND	--	--	--	--
Ni	22/09/82	--	--	--	--	--	1	--	--	--	2	2	--	--	--	7	ND
ug/l	29/09/82	4	15	15	1	1	2	--	--	--	--	--	--	--	--	--	--
	15/10/82	--	--	--	--	--	1	--	--	2	--	2	1	2	50*	6	2
	04/11/82	--	--	--	--	--	--	2	ND	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Zn	22/09/82	--	--	--	--	--	2	--	--	--	18	2	--	--	--	10	ND
ug/l	29/09/82	50*	14	14	4	3	5	--	--	--	--	--	--	--	--	--	--
	15/10/82	--	--	--	--	--	3	3	--	--	--	2	2	5	20	3	2
	04/11/82	--	--	--	--	--	--	19	4	--	--	--	--	--	--	--	--
	05/11/82	--	--	--	--	--	--	--	--	--	--	--	7	--	--	--	--

"*" indicates a concentration in exceedance of the Provincial Water Quality Objective or Guideline
"--" indicates no result available
"ND" indicates not detected

6.1.2 Lakefilling

December 1, 1982:

The December 1, 1982 results for the open lake stations showed that in general metals levels obtained from surface water sampling (Table 6.1) over the Main STP outfall, near the lakefilling activity, and over the Island and R.C. Harris filtration plant intakes were similar and provided no indication that lakefilling activities were responsible for even localized increases. However, it is possible that surface water sampling may not have adequately represented subsurface conditions due to the presence of subsurface turbidity plumes.

Copper was detected in exceedance of the 5 ug/l PWQO over the Main STP outfall (7 ug/l), near the lakefilling activity (6 ug/l), and over both the Toronto Island and R.C. Harris filtration plant intakes (6 ug/l at both). However, no exceedance of the 1 mg/l Ontario Drinking Water Objectives (MOE 1983) was recorded.

April 26, 1983:

Sampling on April 26, 1983 (and June 30) was undertaken from selected depths of greatest turbidity (Table 3.1). Copper and nickel levels nearest the lakefilling exceeded those measured at the Main STP outfall which in turn exceeded those detected near the Toronto Island and R.C. Harris filtration plant intakes (Table 6.1). Levels of chromium, lead and zinc were approximately equal at the lakefilling and Main STP outfall locations with values greater than those detected near both filtration plant intakes (Table 6.1). Cadmium levels were approximately equal at the lakefilling station and the filtration plant stations with the result from the Main STP outfall location an order of magnitude greater (Table 6.1).

Cadmium and copper levels exceeded the PWQO levels for all stations; zinc exceeded the PWQO at the Main STP outfall and lakefilling stations only (Table 6.1). No results were detected above the Ontario Drinking Water Objectives.

June 30, 1983:

Subsurface results corresponding to the depth of greatest turbidity on June 30, 1983 showed distinctly greater values of lead and zinc near the lakefilling site than near either of the filtration plant intakes or the Main STP outfall, although not in exceedance of the PWQO. Exceedances of the PWQO for copper and cadmium were found at all stations sampled (Table 6.1).

6.1.3 Dredged Spoils Disposal

June 30, 1983:

Subsurface sampling at the mouth of the East Headland Cell #2 on June 30, 1983 showed diminished metals levels (Table 6.1) similar to those found near both filtration plant intakes and, in general, lower than those found near the lakefilling site.

6.2 Adverse Weather Surveys

6.2.1 Dredging

September 29, 1982:

On September 29, 1982, following intense precipitation (see Table 3.2) chromium and zinc levels were measured near the dredge site (2017) to be approximately three times greater than levels in the lower Don River (2020), although in the absence of replicate sampling the significance of this difference cannot be determined (Table 6.2). These elevations were confined to within 250 m of the dredge site (Table 6.2).

The PWQO was exceeded for cadmium, copper, and zinc at the Don River station (2020), and for copper at the dredge site (2017) and 100 m downstream from the dredge site (Table 6.2).

6.2.2 Lakefilling

September 22, 1982:

Results for the September 22, 1982 survey, during moderately high east winds with currents towards the SW (see Table 3.2), revealed maximum concentrations over the Main STP outfall (1419) for copper, chromium, and nickel (Table 6.2). Maximum concentrations of cadmium and zinc were detected 100 m downrange from the lakefilling site. The PWQO was greatly exceeded for cadmium 100 m downrange from the lakefilling site (18 ug/l), and for copper over the Main STP outfall (9 ug/l). This extreme cadmium level may have been caused by sample contamination in the field.

This pattern differed from the calm weather surface water quality observations where results from near the lakefill (1987), and over the Main STP outfall (1419) were generally similar to other open lake locations. Elevations near the the Main STP outfall may have been related to wet weather flows from the plant.

There was no indication of localized increases in copper, chromium, lead, and nickel near the lakefilling, and no exceedances of the PWQO were measured.

October 15, 1982:

On October 15, 1982 during high winds from the NW and currents towards the NE (see Table 3.2), a pattern similar to that detected during calm weather surface water sampling was observed with generally similar results at all open lake stations for the

parameters listed in Table 6.2. There was no indication that lakefilling was responsible for localized increases in metals concentrations. A localized increase in nickel was observed over the Main STP outfall, however, no PWQO exceedances were measured.

November 5, 1982:

Only one station was sampled on November 5, 1982, 500 m downrange from the lakefilling, and no metals were detected above the PWQO.

6.2.3 Dredged Spoils Disposal

November 4, 1982:

On November 4, 1982 following prolonged precipitation (see Table 3.2) sampling was undertaken in the disposal cell, East Headland Cell #1 (1989), and at the mouth of the East Headland Cell #2 (2018). Levels of lead and zinc within the disposal cell greatly exceeded those at the mouth of Cell #2 suggesting that dredged spoils disposal was responsible for extreme but localized increases in the concentrations of these metals (Table 6.2). The difference was less marked for other metals in Table 6.2 although there was no indication that disposal operations were directly responsible for any increase at the mouth of Cell #2. Copper exceeded the PWQO at both stations (9 ug/l at Cell #1, 6 ug/l at Cell #2).

7. TRACE ORGANICS RESULTS

Sampling for trace organics was carried out simultaneously with sampling for other parameters. Scans were requested for a total of 42 parameters including PCBs and organochlorine pesticides, phenoxy acid herbicides, organophosphorus insecticides, and chlorophenol insecticides. Results for the 11 compounds which were detected (i.e. with levels greater than the minimum reportable amount) during calm and adverse weather surveys have been presented in Appendix A3.

7.1 Calm Weather Surveys

In general, the frequency of detection of trace organics was too low to allow any assessment of increased levels as the result of dredging or lakefilling activities. Detectable levels of these compounds (Appendix A3) during calm conditions were found most commonly in the Main STP treated effluent, and less commonly near the Main STP outfall, in the Don River, and in the northeast corner of the Inner Harbour.

The only exception to the generally low frequency of detection was the compound alpha-BHC (hexachlorocyclohexane) which was detected at levels from 2 to 10 times the minimum reportable amount of 1 ng/l in all but 1 of the 30 calm weather samples taken. This ubiquitous pattern of detection could not be related to dredging or lakefilling activities. Furthermore, alpha-BHC levels were generally greater than those for gamma-BHC (i.e. lindane, the commercially used pesticide) suggesting that biotransformation of lindane from the gamma to the alpha isomer may have been taking place. Such a transformation has been identified as a potentially significant source of alpha-BHC in the environment by the U.S. Environmental Protection Agency (1979).

PCBs were not detected in receiving water during calm weather but were measured in the Main STP treated effluent on December 1, 1982 at a level of 35 ng/l.

7.2 Adverse Weather Surveys

The general pattern for detection of trace organics was the same for adverse weather as for calm. No effects of dredging or lakefilling activity could be discerned, and detectable levels were again found most commonly in the Main STP treated effluent, and less frequently over the Main STP outfall, in the lower Don River, and in the northeast corner of the Inner Harbour (Appendix A3).

As during calm surveys, alpha-BHC was frequently detected, in this case in 20 of 21 adverse weather samples taken (Appendix A3).

PCBs were not detected in receiving water during adverse weather but were measured in the Main STP treated effluent on October 15, 1982 at a level of 20 ng/l.

8. SEDIMENT QUALITY RESULTS

On September 21, 1982, a composite sample of dredged spoils was collected from the Toronto Harbour Commission scow for sediment analysis. Dredged spoils sampling was not continued since sediment quality had already been well established through previous sampling (Golder Associates 1980, Ontario Ministry of the Environment 1980). In addition to the dredged spoils sample, suspended sediment samples were concentrated by centrifuge within the East Headland Cell #1 and at the mouth of Cell #2 on November 4, 1982, and 500 m downrange from the lakefilling site on November 5, 1982.

Results for mercury, PCBs, lead, cadmium, oil and grease, total phosphorus, and arsenic have been presented (Tables 8.1, 8.2); results for other parameters have been listed in Appendix A5. These seven listed parameters are among the most commonly used in assessment of dredging projects and have been compared (see Section 8.1) with the Ontario Ministry of the Environment Guidelines for Dredge Spoils for Open Water Disposal (Persaud and Wilkins 1976).

These open water disposal guidelines were developed as a general means of suggesting that contamination has occurred. However, there are several limitations which preclude their application as absolute criteria in the assessment of sediment quality. First of all, they rely on bulk chemistry results and make no allowance for the influence of grain size on contaminant concentrations, and second, they were empirically derived and do not attempt to relate contaminant concentrations to specific adverse impacts on biota since an understanding of the significance of sediment chemistry in uptake and bioaccumulation is at present incomplete.

There has also been discussion concerning high levels of certain parameters, particularly heavy metals, in natural sediment sources and lake backgrounds in comparison to the open water disposal guidelines (Thomas and Mudroch 1979) which has required that their application be flexible. The above list of seven parameters, however, remains virtually unaffected by these findings with the

TABLE 8.1 DREDGED SPOILS QUALITY, SEPTEMBER 21, 1982,

	DRY WEIGHT CONCENTRATIONS (ppm)	
	Open Water Disposal Guideline*	Dredged Material Grab Sample (21/9/82)
Total P	1000	1600
Arsenic	8.0	10.77
Cadmium	1.0	1.70
Mercury	0.3	0.21
Lead	50	170
Oil/Grease	1500	3800
PCBs	0.05	0.32

* From MOE Guidelines for Dredge Spoils for Open Water Disposal (Persaud and Wilkins 1976).

TABLE 8.2 SUSPENDED SOLIDS QUALITY (NOVEMBER 4/5, 1982)

	DRY WEIGHT CONCENTRATIONS (ppm) Centrifuged Suspended Solids		
PARAMETER	Cell #1 Stn 1989 4/11/82)	Cell #2 Stn 2018 (4/11/82)	Lakefill +500m (5/11/82)
Arsenic	13.20	8.42	8.35
Cadmium	2.90	3.70	0.86
Lead	180	240	120
PCBs	ND	ND	0.024

ND = Not detected above the minimum reportable amount of 0.02 ppm

only exception being cadmium. This was reported by Thomas and Mudroch (1979) as being found at 1.5 ppm in bluff material as compared to a open water disposal guideline of 1.0 ppm.

8.1 Dredged Spoils Quality

Results of analysis for dredged spoils (Table 8.1) showed that levels of all parameters except mercury exceeded the open water disposal guidelines. Although the quality of the dredged spoils cannot be adequately assessed on the basis of one composite sample the result was consistent with previous extensive sampling results (Golder Associates 1980, Ontario Ministry of the Environment 1980) and confirmed the need for confined disposal of this material.

8.2 Suspended Sediment Quality

Interpretation of suspended sediment chemistry is of benefit in that it provides a more sensitive presence/absence indication than small volume water quality results for compounds with low solubility such as heavy metals and trace organics. Also, depending upon the subsequent transport and deposition of these suspended sediments, high contaminant concentrations may indicate future contamination of area lake bottom sediments.

Results for centrifuged suspended solids (Table 8.2) showed relatively high levels for arsenic, cadmium, and lead within the disposal cell (1989), for cadmium and lead at the mouth of East Headland Cell #2 (2018), and for lead 500 m downrange from the lakefilling site. Total PCBs were also detected 500 m downrange from the lakefilling at a level slightly above the 0.020 ppm minimum reportable amount, and the alpha and gamma isomers of chlordane were detected at twice the minimum reportable amount of 0.002 ppm (Appendix A5).

These preliminary results suggest that the most contaminated suspended sediments were contained in Cell #1 and resulted from the disposal of contaminated dredged spoils. They also suggest that sediment particles with elevated concentrations of adsorbed lead and certain trace organics were transported away from the East Headland on November 5, 1982 although more intensive sampling will be required to determine if this was a generally representative finding.

Since the concentration of suspended solids has been observed to remain relatively low in the open lake at the surface (see Section 4) migration of contaminants adsorbed to sediment particles would be expected to have little or no short-term impact on surface water quality. This has been reflected by previous water quality sampling (Griffiths 1980, 1983, Griffiths and Winiecki 1981) as well as by the water quality results obtained on November 5, 1982 at the suspended sediment sampling location which failed to detect lead, PCBs, or chlordane in the water.

Depending upon the transport and deposition of these sediment particles the potential exists for long-term (i.e. seasonal) impacts on area sediment quality and further study will be required to (a) establish a quantitative assessment of the relative contributions of various inputs of contaminated sediment throughout the study area (i.e. rivers, STP outfalls, sewer outfalls), and (b) to establish the significance of sediment chemistry on aquatic biota.

9. DISCUSSION AND CONCLUSIONS

9.1 General Findings

Surveys in the Toronto waterfront were undertaken during 1982 and 1983 under calm and adverse weather conditions to monitor short-term surface water effects of dredging in the northeast corner of the Inner Harbour, and dredged spoils disposal and lakefilling at the East Headland. Major findings were as follows:

(a) Water quality effects, as determined by measuring physical parameters and nutrients were localized and could not be measured except in the immediate vicinity of the dredging, dredged spoils disposal, and lakefilling operations. Water quality analysis for concentrations of metals found occasional localized elevations in the immediate vicinity of dredging, dredged spoils disposal, and lakefilling operations although the significance of these findings could not be assessed quantitatively due to the small sample size and the proximity of other inputs such as the Don River and the Toronto Main sewage treatment plant (STP). No evidence of increases in concentrations of trace organics was found and no adverse impacts on water quality throughout the Toronto waterfront or on drinking water supplies at the Toronto Island and R.C. Harris filtration plants were detected.

(b) Over the study area in general, the highest levels of contaminants (nutrients, metals, trace organics) were found in the lower Don River and over the Main STP outfall. In many cases, the influence of these inputs prevented the isolation of effects from dredging and lakefilling operations except in their immediate vicinity.

(c) Preliminary investigations (involving turbidity profiling throughout the water column and the collection of suspended sediments) in the vicinity of the East Headland documented the loss of material to Lake Ontario with detectable levels of adsorbed trace contaminants (i.e metals and trace organics).

These compounds have low solubility in water and, consequently, it can be assumed that any measurement of associated water quality impairment will depend, to a significant extent, upon the presence of contaminated suspended solids within the water column. As a result, the product of the concentration of suspended sediments in a sampled volume of water and the concentration of a given contaminant within the suspended sediments can be used as a preliminary estimate of the potential for water quality impairment.

Water quality sampling for metals and trace organics throughout the study area confirmed predictions that concentrations of suspended solids were generally too low to result in any measurable effect on water quality at small sample volume (1 litre) limits of detection. Detection of elevated metal levels were chiefly associated with highly turbid areas in the lower Don River, the northeast corner of the Inner Harbour, within the East Headland Cell #1, and occasionally over the Main STP outfall and near the lakefilling activity. Trace organics were not detected with sufficient frequency to identify any localized increases associated with potential sources.

Although the short-term effects of lakefilling activities on water quality were demonstrated to be localized, further investigation is required to assess the potential effects of these suspended sediments on the aquatic ecosystem and area sediment quality.

9.2 Effects of Dredging

(a) Calm Weather

Elevations of turbidity, suspended solids, and conductivity near the dredging site were localized and no extensive plumes were evident. No significant increases of nutrients, metals, or trace organics were observed.

A composite grab sample of dredged material taken from the THC scow on September 21, 1982 showed it to be unacceptable for open water disposal.

(b) Adverse Weather

Following intense precipitation (no dredging activity took place during high winds), the increased flows from runoff to the Don River resulted in an extensive surface plume in the northeast corner of the Inner Harbour and masked any potential elevation of conductivity associated with dredging operations. Localized increases in turbidity, suspended solids, chromium, and zinc concentrations were detected near the dredge. These, however, could not be attributed solely to dredging operations in view of wet weather flows from the lower Don River. There was no indication of any increase in levels of trace organics.

9.3 Effects of Lakefilling

(a) Calm Weather

The extent of surface turbidity plumes was observed to vary from 250 m to 500 m and turbidity - depth profiling for stations near the lakefilling indicated that turbidities near the lake bed were higher than at the surface. Similar, but less intensive, turbidity gradients were found both east and west of the lakefilling site, over the Toronto Island and R.C. Harris filtration plant intakes. This suggests that similar turbidity gradients existed throughout the nearshore zone, either as a residual effect of previous generalized nearshore turbidity (caused by high winds before the calm weather surveys), or due to the presence of hypolimnetic currents. This subsurface turbidity is of significance since the intakes at both the Toronto Island and R. C. Harris filtration plants are situated approximately 5 m from the lake bottom.

Locally elevated nutrient concentrations were detected at the lakefilling site but were generally well below those detected over the Main STP outfall. No local elevation of metals levels was noted in the surface water near the lakefilling site. However, when samples were obtained from the depth of maximum turbidity near the lake bed exceedances of the Provincial Water Quality Objectives for the protection of aquatic life and recreation for cadmium, copper, and zinc were detected and apparent local elevations in lead and nickel were measured (although their significance could not be assessed on the basis of the limited sampling). There was no observed increase in concentrations of trace organics.

(b) Adverse Weather

The extent of surface turbidity plumes was observed to vary from 500 m to 1000 m. Turbidity - depth profiling demonstrated that near the lakefilling (a surface input of suspended solids) the surface turbidity exceeded the subsurface turbidity but that at other stations turbidity remained fairly uniform throughout the water column. Mixing conditions under high winds in the relatively shallow depths near the lakefilling were assumed to have been dominated by surface waves, however, the lack of temperature profiles and a detailed current record mean that this could not be verified.

Localized increases in nutrients were detected near the lakefilling although once again maximum levels were found over the Main STP outfall. Metals sampling demonstrated no increases associated with lakefilling but a greater range of concentrations was detected between the open lake stations and over the Main STP outfall. There was no observed effect on levels of trace organics.

Analysis of a suspended sediment sample from 500 m downrange from the lakefilling showed an elevated lead concentration as well as trace concentrations of PCBs and chlordane. Results also showed suspended sediments at this location to be generally less contaminated than those contained within the East Headland Cell #1 (the disposal area for dredged spoils), and of better quality than those measured at the mouth of Cell #2.

These results did not lead to any exceedance of the Provincial Water Quality Objectives for the protection of aquatic life and recreation or the Ontario Drinking Water Objectives since concentrations of suspended sediment detected near the lakefill remained relatively low. The impact of these findings upon aquatic biota has not yet been fully investigated nor has the potential for effects of contaminated suspended sediments upon area lake bed sediments.

9.4 Effects of Dredged Spoils Disposal

(a) Calm weather

A uniform profile of low turbidity was measured at the mouth of East Headland Cell #2 and aerial observation of surface turbidity indicated that elevated turbidity was confined to Cell #1.

Concurrent water quality sampling found no evidence of elevated nutrients, metals, or trace organic levels at the mouth of Cell #2.

(b) Adverse Weather

Observation of surface turbidity following prolonged precipitation (disposal operations were suspended during high winds) revealed a similar situation to that observed during calm conditions with elevated turbidity confined to Cell #1.

Turbidity in Cell #2 appeared to be chiefly the result of erosion and resuspension from the inner arm of the East Headland. Uniform turbidity - depth profiles were obtained within Cell #1 and near the mouth of Cell #2 making surface observations a reasonable indicator of conditions throughout the water column.

Water quality sampling showed elevated levels of lead and zinc in Cell #1 only, and no increases in trace organic concentrations were observed.

Analysis of suspended sediment samples revealed the presence of arsenic, cadmium, and lead within Cell #1, and cadmium and lead at the mouth of Cell #2. As previously stated, these findings did not result in water quality impairment outside Cell #1, and their significance regarding lake bed sediment quality and potential impacts on the aquatic ecosytem has not yet been investigated.

10. FUTURE PROGRAMS

1. A review and statistical analysis of heavy metal and trace organics water quality data collected over the years 1976 - 1983 across the Toronto waterfront is being initiated. The results should provide further insight into water quality differences between locations and will provide a statistical basis for conclusions regarding the most significant factors affecting the detection of trace contaminants in water.

2. Turbidity has been demonstrated to be a good indicator of suspended solids concentrations and an increase in the fine grain fraction of suspended solids is anticipated to be associated with an increase in the concentration of heavy metals and trace organics (due to their low solubility). As a result, sampling in 1984 for metals and trace organics will be undertaken in zones of high turbidity, from the depth of greatest turbidity, utilizing a replicate sampling procedure. This procedure will also be employed at control stations.

3. Preliminary results from 1982/83 have shown that analysis of suspended sediments can reveal elevated concentrations of certain trace contaminants in the absence of marked water quality impairment. These preliminary findings will be further investigated in 1984 by obtaining more suspended sediment samples in the vicinity of inputs (i.e. dredging, dredged spoils disposal, lakefilling, Don River, Main STP) for particle size analysis as well as chemistry. This information will be used in conjunction with lake current records and sediment trap sampling results to provide an initial estimate of the zone of influence for sediment associated contaminants.

4. Currently, MOE programs are under development to document existing sediment quality at the lake bed throughout the Toronto waterfront and to assess the impact of sediment chemistry upon the aquatic ecosystem. The ultimate goal of these programs is the development of improved sediment quality management guidelines and abatement of water quality impairment if and where it arises from sediment contamination.

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APPENDICES

APPENDIX A1: PARAMETER LIST

Physical Parameters and Nutrients

Total chlorophyll-a	Conductivity 25°C
Total Hardness	Unfilt. reactive calcium
Unfilt. reactive magnesium	Total alkalinity
pH	Suspended solids
Turbidity	Unfilt. reactive phenolics
Unfilt. total phosphorus	Filt. reactive phosphates
Total Kjeldahl nitrogen	Total filt. reactive ammonium
Total filt. reactive nitrates	Dissolved organic carbon

Inorganic Trace Contaminants

(all parameters unfilt. total unless noted)

Iron	Manganese
Aluminum	Arsenic
Barium	Beryllium
Free unfilt. reactive cyanide	Cadmium
Cobalt	Chromium
Mercury unfilt.	Mercury filt.
Molydenum	Nickel
Lead	Selenium
Strontium	Titanium
Vanadium	Zinc
Copper	Silver

Trace Organics

Aldrin	alpha-BHC
beta-BHC	gamma-BHC
alpha-chlordane	gamma-chlordane
Dieldrin	DMDT methoxychlor
Endosulfan I	Endosulfan II
Endrin	Endosulfan sulphate
Heptachlorepoxide	Heptachlor
Mirex	Oxychlordane
o,p-DDT	Total PCB
p,p-DDT	p,p-DDE
p,p-DDD	Diazinon
Dichlorovos	Dursban
Ethion	Guthion
Malathion	Mevinphos
Methylparathion	Methyltrithion
Parathion	Phorate (Thimet)
Reldan	Ronnel
Hexachlorobenzene	2,3,4 Trichlorophenol
2,3,4,5 Tetrachlorophenol	2,3,5,6 Tetrachlorophenol
2,4,5 Trichlorophenol	2,4,6 Trichlorophenol
Toxaphene	2,4,5 Trichlorophenoxyacetic.
2,4, Dichlorophenoxyacetic.	2,4 Dichlorophenoxybutyrc.
2,4 D propionic acid	Dicamba
Picloram	Silvex

APPENDIX A2

DATA LISTING FOR PHYSICAL TESTS
AND NUTRIENTS

Notation Used:

"A" indicates an approximate result.
"<T" indicates a result which may not differ from zero.
"<" indicates result less than reported value.
"*" indicates a result in exceedance of the Provincial Water Quality Objectives for the protection of aquatic life and recreation.

PARAMETER : TOTAL CHLOROPHYLL A. MIN. REPORTABLE CONCENTRATION :
UNITS : (UG/L) MOE.OBJECTIVE : NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	1.9		4.4						
CHERRY ST (1379)							6.2		
DREDGE SITE (2017)	6.2		7.4						
DREDGE SITE +100 M	8.6		6.9						
DREDGE SITE +250 M	7.8		4.4						
INNER HARBOUR (1364)	8.6		8.0				5.5		
ISLAND INTAKE (1536)	4.3	6.8	8.7	2.5			2.4	4.1	
CELL #1 (1989)					6.1				
CELL #2 (2018)									
LAKEFILLING SITE (1987)		3.4		1.8			2.9	5.8	
LAKEFILLING SITE +100 M		3.5							
LAKEFILLING SITE +250 M		2.5		1.5					
LAKEFILLING SITE +500 M				1.4		7.8			
LAKEFILLING SITE +1000 M				18.2					
MAIN STP OUTFALL (1419)	1.9	4.4		2.5			4.1	4.1	
RC HARRIS INTAKE (2029)	3.9	5.6		3.0			2.8	4.8	
ISLAND IN-PLANT RAW									
RC HARRIS RAW	1.7						4.5		
MAIN STP TREATED EFF	1.7								

PARAMETER : CONDUCTIVITY MIN. REPORTABLE CONCENTRATION :
UNITS : US/CM MOE.OBJECTIVE : NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	341		879						
CHERRY ST (1379)							393		
DREDGE SITE (2017)	592		634						
DREDGE SITE +100 M	393		539						
DREDGE SITE +250 M	347		347						
INNER HARBOUR (1364)	355		322				392		
ISLAND INTAKE (1536)	323	334	322	320			327	329	
CELL #1 (1989)					333				
CELL #2 (2018)					330				
LAKEFILLING SITE (1987)		335		325			341	345	
LAKEFILLING SITE +100 M		339							
LAKEFILLING SITE +250 M		334		324			336		
LAKEFILLING SITE +500 M				325		328			
LAKEFILLING SITE +1000 M				324					
MAIN STP OUTFALL (1419)	389	343		346			373	443	
RC HARRIS INTAKE (2029)	325	322		323			329	322	
ISLAND IN-PLANT RAW	320								
RC HARRIS RAW	328						332		
MAIN STP TREATED EFF	880			931			1030		

PARAMETER : HARDNESS CACO3 MIN. REPORTABLE CONCENTRATION :
UNITS : MG/L MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	281		279						
CHERRY ST (1379)							142		
DREDGE SITE (2017)	189		205						
DREDGE SITE +100 M	138		177						
DREDGE SITE +250 M	126		125						
INNER HARBOUR (1364)	127		120				139		125
ISLAND INTAKE (1536)	120	125	119	122			123	126	120
CELL #1 (1989)					131				
CELL #2 (2018)					129				
LAKEFILLING SITE (1987)		121		125			128	134	
LAKEFILLING SITE +100 M		125							
LAKEFILLING SITE +250 M		123		123			126		
LAKEFILLING SITE +500 M				124		142			
LAKEFILLING SITE +1000 M				123					
MAIN STP OUTFALL (1419)	130	124		127			130	169	
RC HARRIS INTAKE (2029)	122	121		121			126	130	
ISLAND IN-PLANT RAW	127								
RC HARRIS RAW	121						131		
MAIN STP TREATED EFF	181			172			203		

PARAMETER : CALCIUM UNF.,REACTIVE MIN. REPORTABLE CONCENTRATION : 0.5 UG/L
UNITS : MG/L MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	89.5.		90.5.						
CHERRY ST (1379)							43.6.		
DREDGE SITE (2017)	60.5.		66.6.						
DREDGE SITE +100 M	43.5.		57.0.						
DREDGE SITE +250 M	39.0.		39.0.						
INNER HARBOUR (1364)	39.5.		37.0.				42.9.		36.2.
ISLAND INTAKE (1536)	37.5.	37.5.	36.5.	36.3.			37.3.	37.8.	36.9.
CELL #1 (1989)					39.8.				
CELL #2 (2018)					38.9.				
LAKEFILLING SITE (1987)		37.5.		37.5.			39.0.	40.9.	
LAKEFILLING SITE +100 M		38.5.							
LAKEFILLING SITE +250 M		38.0.		36.6.			38.4.		
LAKEFILLING SITE +500 M				37.2.		43.5.			
LAKEFILLING SITE +1000 M				36.9.					
MAIN STP OUTFALL (1419)	40.0.	38.5.		38.2.			39.6.	51.1.	
RC HARRIS INTAKE (2029)	37.5.	37.0.		36.2.			38.4.	39.2.	
ISLAND IN-PLANT RAW	38.0.								
RC HARRIS RAW	37.5.						40.4.		
MAIN STP TREATED EFF	54.5.			52.1.			62.5.		

PARAMETER : MAGNESIUM UNF., R. MIN. REPORTABLE CONCENTRATION : 0.138 UG/L
UNITS : MG/L MOE. OBJECTIVE: NONE

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	14.0.		13.0.						
CHERRY ST (1379)							8.0.		
DREDGE SITE (2017)	9.4.		9.4.						
DREDGE SITE +100 M	7.4.		8.4.						
DREDGE SITE +250 M	6.8.		6.8.						
INNER HARBOUR (1364)	6.8.		6.8.				7.8.		8.4.
ISLAND INTAKE (1536)	6.6.	7.8.	6.8.	7.7.			7.4.	7.8.	7.9.
CELL #1 (1989)					7.8.				
CELL #2 (2018)					7.7.				
LAKEFILLING SITE (1987)		6.6.		7.7.			7.4.	7.8.	
LAKEFILLING SITE +100 M		7.0.							
LAKEFILLING SITE +250 M		6.8.		7.6.			7.4.		
LAKEFILLING SITE +500 M				7.6.		8.2.			
LAKEFILLING SITE +1000 M				7.6.					
MAIN STP OUTFALL (1419)	7.2.	7.0.		7.7.			7.6.	10.1.	
RC HARRIS INTAKE (2029)	6.8.	6.8.		7.5.			7.4.	7.8.	
ISLAND IN-PLANT RAW	8.0.								
RC HARRIS RAW	6.6.						7.4.		
MAIN STP TREATED EFF	9.8.			10.3.			11.5.		

PARAMETER : TOTAL ALKALINITY MIN. REPORTABLE CONCENTRATION : 1.44 UG/L
UNITS : MG/L CACO3 MOE. OBJECTIVE: NONE

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	198.8.		203.9.						
CHERRY ST (1379)							106.4.		
DREDGE SITE (2017)	140.2.		157.8.						
DREDGE SITE +100 M	108.3.		133.6.						
DREDGE SITE +250 M	97.6.		98.3.						
INNER HARBOUR (1364)	98.7.		94.2.				106.4.		99.8.
ISLAND INTAKE (1536)	94.5.	95.6.	93.6.	94.9.			95.2.	95.3.	94.7.
CELL #1 (1989)					99.2.				
CELL #2 (2018)					95.5.				95.6.
LAKEFILLING SITE (1987)		94.8.		96.2.			95.5.	100.4.	96.3.
LAKEFILLING SITE +100 M		96.5.							
LAKEFILLING SITE +250 M		95.3.		95.6.			95.2.		
LAKEFILLING SITE +500 M				95.4.		95.7.			
LAKEFILLING SITE +1000 M				95.5.					
MAIN STP OUTFALL (1419)	92.6.	93.8.		95.5.			96.4.	134.8.	
RC HARRIS INTAKE (2029)	95.2.	94.1.		95.3.			95.0.	95.4.	96.7.
ISLAND IN-PLANT RAW	96.9.								
RC HARRIS RAW	97.2.						99.2.		
MAIN STP TREATED EFF	177.2.			83.8.			120.3.		

PARAMETER : PH MIN. REPORTABLE CONCENTRATION :
UNITS : STANDARD UNITS MOE. OBJECTIVE: 6.5-8.5

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	7.54.		7.53.						
CHERRY ST (1379)							8.11.		
DREDGE SITE (2017)	7.47.		7.78.						
DREDGE SITE +100 M	7.99.		7.58.						
DREDGE SITE +250 M	8.00.		8.04.						
INNER HARBOUR (1364)	7.94.		8.28.				8.07.		
ISLAND INTAKE (1536)	8.38.	8.09.	8.30.	8.15.			7.98.	7.87.	
CELL #1 (1989)					7.79.				
CELL #2 (2018)					8.05.				
LAKEFILLING SITE (1987)		7.88.		8.08.			8.11.	8.20.	
LAKEFILLING SITE +100 M		7.83.							
LAKEFILLING SITE +250 M		7.81.		8.21.			8.10.		
LAKEFILLING SITE +500 M				8.12.		8.18.			
LAKEFILLING SITE +1000 M				8.08.					
MAIN STP OUTFALL (1419)	7.97.	7.25.		8.23.			8.04.	7.52.	
RC HARRIS INTAKE (2029)	8.37.	8.27.		8.26.			8.18.	8.23.	
ISLAND IN-PLANT RAW	8.29.								
RC HARRIS RAW	8.35.						8.09.		
MAIN STP TREATED EFF	6.68.			7.58.			7.42.		

PARAMETER : PHENOLICS MIN. REPORTABLE CONCENTRATION : 0.2 UG/L
UNITS : UG/L MOE. OBJECTIVE: 1 UG/L

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	1.2		0.8						
CHERRY ST (1379)							0.4 <T		
DREDGE SITE (2017)	3.4		0.8						2.6
DREDGE SITE +100 M	1.4		1.2						
DREDGE SITE +250 M	0.2 <T		0.4 <T						
INNER HARBOUR (1364)	1.8		0.6 <T				0.2 <T		1.2
ISLAND INTAKE (1536)	A0.2 <T	0.6 <T	0.4 <T	0.4 <T			0.2 <T	0.2 <T	1.6
CELL #1 (1989)					0.2 <T				
CELL #2 (2018)					0.8				1.4
LAKEFILLING SITE (1987)		0.8		ND			ND	0.2 <T	1.2
LAKEFILLING SITE +100 M		0.6 <T							
LAKEFILLING SITE +250 M		0.6 <T					0.2 <T		
LAKEFILLING SITE +500 M				ND					
LAKEFILLING SITE +1000 M				0.2 <T					
MAIN STP OUTFALL (1419)	A0.6 <T	0.2 <T		0.6 <T			0.2 <T	0.4 <T	1.2
RC HARRIS INTAKE (2029)	A0.4 <T	0.2 <T		0.2 <T			1.2	0.2 <T	1.8
ISLAND IN-PLANT RAW	A0.2 <T								
RC HARRIS RAW	A0.2 <T						0.4 <T		
MAIN STP TREATED EFF	<T 1.6			2.2			2.6		

PARAMETER : SUSPENDED SOLIDS
UNITS : (MG/L)

MIN. REPORTABLE CONCENTRATION : 0.2 MG/L.
MOE.OBJECTIVE : NONE

LOCATION	1982								1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.	
DON RIVER (2020)	10.60		17.90.							
CHERRY ST (1379)							4.87.			
DREDGE SITE (2017)	20.80		36.50.							
DREDGE SITE +100 M	7.35		21.80.							
DREDGE SITE +250 M	3.29		3.05.							
INNER HARBOUR (1364)	2.84.		1.81.				5.95.			
ISLAND INTAKE (1536)	1.73	1.62	3.07.	1.20.			1.45.	1.59.		
CELL #1 (1989)					41.30.					
CELL #2 (2018)					8.30.					
LAKEFILLING SITE (1987)		8.28.		2.58.			8.73.	10.90.		
LAKEFILLING SITE +100 M		5.75.								
LAKEFILLING SITE +250 M		5.57.		5.35.			3.94.			
LAKEFILLING SITE +500 M				4.00.						
LAKEFILLING SITE +1000 M				12.30.						
MAIN STP OUTFALL (1419)	3.57	5.79		5.49.			9.59.	12.90.		
RC HARRIS INTAKE (2029)	1.28	A0.40		2.62.			2.12.	2.01.		
ISLAND IN-PLANT RAW	2.08									
RC HARRIS RAW	1.18						7.40.			
MAIN STP TREATED EFF	13.00			11.60.			41.00.			

PARAMETER : TURBIDITY
UNITS : F.T.U.

MIN. REPORTABLE CONCENTRATION : 0.42 F.T.U.
MOE.OBJECTIVE : NONE

LOCATION	1982								1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.	
DON RIVER (2020)	6.10		16.8							
CHERRY ST (1379)							3.30.			
DREDGE SITE (2017)	10.20		32.0							
DREDGE SITE +100 M	6.40		25.0							
DREDGE SITE +250 M	1.81		4.4							
INNER HARBOUR (1364)	3.50.		2.1	4.80.					2.40.	
ISLAND INTAKE (1536)	1.01	1.78	2.3	1.93.			1.24.	1.40.	1.20.	
CELL #1 (1989)					29.0					
CELL #2 (2018)					3.2				6.50.	
LAKEFILLING SITE (1987)		4.6		10.40.			2.90.	7.40.	60.00.	
LAKEFILLING SITE +100 M		3.9								
LAKEFILLING SITE +250 M		2.6		6.4			2.80.			
LAKEFILLING SITE +500 M				3.6		24.0				
LAKEFILLING SITE +1000 M				10.5						
MAIN STP OUTFALL (1419)	3.70	5.1		4.70.			6.20.	5.90.		
RC HARRIS INTAKE (2029)	1.07	1.31		1.22.			1.08.	1.10.	7.50.	
ISLAND IN-PLANT RAW	.89									
RC HARRIS RAW	1.86						5.80.			
MAIN STP TREATED EFF	6.80			7.90.			25.00.			

PARAMETER : TOTAL PHOSPHORUS
UNITS : (UG/L)

MIN. REPORTABLE CONCENTRATION : 9 UG/L
MOE. GUIDELINE: 20 UG/L

LOCATION	1982								1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.	
DON RIVER (2020)	260#.		135#.							
CHERRY ST (1379)							35#.			
DREDGE SITE (2017)	99#.		145#.						115#.	
DREDGE SITE +100 M	70#.		100#.							
DREDGE SITE +250 M	28#.		31#.							
INNER HARBOUR (1364)	34#.		26#.				36#.		36#.	
ISLAND INTAKE (1536)	22#.	18	28#.	15			7	15	11	
CELL #1 (1989)										
CELL #2 (2018)					17				17	
LAKEFILLING SITE (1987)		32#.		25#.			38#.	31#.	104#.	
LAKEFILLING SITE +100 M		35#.								
LAKEFILLING SITE +250 M		28#.		19			19			
LAKEFILLING SITE +500 M				14		55#.				
LAKEFILLING SITE +1000 M				14						
MAIN STP OUTFALL (1419)	83#.	190#.		110#.			67#.	275#.		
RC HARRIS INTAKE (2029)	14	21#.		11			13	14	20	
ISLAND IN-PLANT RAW	10									
RC HARRIS RAW	22#.						83#.			
MAIN STP TREATED EFF	980#.			2900#.			773#.			

PARAMETER : FILT. REACTIVE PO4
UNITS : (UG/L)

MIN. REPORTABLE CONCENTRATION : 1 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982								1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.	
DON RIVER (2020)	69.0		16.0							
CHERRY ST (1379)							6.0			
DREDGE SITE (2017)	17.0		44.5						26.5	
DREDGE SITE +100 M	14.0		14.0							
DREDGE SITE +250 M	5.0		3.0							
INNER HARBOUR (1364)	8.0		3.0				6.0		13.0	
ISLAND INTAKE (1536)	3.0	6.0	3.0	5.0			2.0 <T	1.0 <T	4.0	
CELL #1 (1989)										
CELL #2 (2018)					5.5				4.0	
LAKEFILLING SITE (1987)		11.0		4.5			15.0	3.0	20.0	
LAKEFILLING SITE +100 M		15.0					5.0			
LAKEFILLING SITE +250 M		12.0		3.5						
LAKEFILLING SITE +500 M				3.0		6.0				
LAKEFILLING SITE +1000 M				3.5						
MAIN STP OUTFALL (1419)	24.0	46.0		26.0			15.0	91.0	36.0	
RC HARRIS INTAKE (2029)	1.0#	3.0		4.0			3.0	1.0 <T	6.5	
ISLAND IN-PLANT RAW	2.0#									
RC HARRIS RAW	8.0						10.0			
MAIN STP TREATED EFF	99.0			90.5			260.0			

PARAMETER : TOTAL KJELDAHL N. MIN. REPORTABLE CONCENTRATION : 0.088 MG/L
UNITS : (MG/L) MOE.OBJECTIVE : NONE

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)	4.50.		2.75.						
CHERRY ST (1379)							.59.		
DREDGE SITE (2017)	2.25.		2.12.						.62.
DREDGE SITE +100 M	1.19.		1.48.						
DREDGE SITE +250 M	0.44.		0.53.						
INNER HARBOUR (1364)	0.52.		0.37.				0.53		0.49.
ISLAND INTAKE (1536)	0.33.	0.32.	0.40.	0.27.			0.20.	0.23.	0.30.
CELL #1 (1989)									
CELL #2 (2018)					0.29.				0.33.
LAKEFILLING SITE (1987)		0.63.		0.23.			0.55.	0.64.	0.42.
LAKEFILLING SITE +100 M		0.66.							
LAKEFILLING SITE +250 M		0.65.		0.22.			0.28.		
LAKEFILLING SITE +500 M				0.21.		0.25.			
LAKEFILLING SITE +1000 M				0.20.					
MAIN STP OUTFALL (1419)	3.40.	2.00.		3.80.			1.44.		
RC HARRIS INTAKE (2029)	0.25.	0.31.		0.22.			0.22.	0.28.	0.37.
ISLAND IN-PLANT RAW	0.19.								
RC HARRIS RAW	0.26.						0.43.		
MAIN STP TREATED EFF	21.00.			20.50.					

PARAMETER : TOTAL AMMONIA AS N. MIN. REPORTABLE CONCENTRATION : 14
UNITS : (UG/L) MOE. OBJECTIVE: NONE

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)	160		1840						
CHERRY ST (1379)							284		
DREDGE SITE (2017)	1740		134						38
DREDGE SITE +100 M	650		890						
DREDGE SITE +250 M	128		110						
INNER HARBOUR (1364)	180		36				288		162
ISLAND INTAKE (1536)	38	32	60	40			14	6	58
CELL #1 (1989)									
CELL #2 (2018)					72				74
LAKEFILLING SITE (1987)		306		20			320	316	178
LAKEFILLING SITE +100 M		370							
LAKEFILLING SITE +250 M		370		28			84		
LAKEFILLING SITE +500 M				18		48			
LAKEFILLING SITE +1000 M				14					
MAIN STP OUTFALL (1419)	2550	1600		3450			1060	6800	910
RC HARRIS INTAKE (2029)	14	22		2 <7			40	34	82
ISLAND IN-PLANT RAW	2								
RC HARRIS RAW	8						68		
MAIN STP TREATED EFF	3400			17500			19300		

PARAMETER : TOTAL NITRATE MIN. REPORTABLE CONCENTRATION : 20 UG/L
UNITS : (UG/L) MOE. OBJECTIVE: NONE

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)	900		1000						
CHERRY ST (1379)							465		
DREDGE SITE (2017)	590		740						980
DREDGE SITE +100 M	360		590						
DREDGE SITE +250 M	270		245						
INNER HARBOUR (1364)	280		170				470		265
ISLAND INTAKE (1536)	210	255	175	290			355	305	170
CELL #1 (1989)									
CELL #2 (2018)					375				175
LAKEFILLING SITE (1987)		285		365			370	345	255
LAKEFILLING SITE +100 M		280							
LAKEFILLING SITE +250 M		280		365			365		
LAKEFILLING SITE +500 M				385		290			
LAKEFILLING SITE +1000 M				365					
MAIN STP OUTFALL (1419)	245	230		345			395	265	405
RC HARRIS INTAKE (2029)	265	205		395			365	310	295
ISLAND IN-PLANT RAW	390								
RC HARRIS RAW	360						380		
MAIN STP TREATED EFF	95			165			290		

PARAMETER : DOC MIN. REPORTABLE CONCENTRATION : 0.49 UG/L
UNITS : (UG/L) MOE. OBJECTIVE: NONE

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)	3.8		4.1						
CHERRY ST (1379)							2.0		
DREDGE SITE (2017)	2.8		3.4						
DREDGE SITE +100 M	2.2		3.0						
DREDGE SITE +250 M	2.1		2.3						
INNER HARBOUR (1364)	3.4		2.1						
ISLAND INTAKE (1536)	2.0	2.0	2.0	2.0			2.1	1.9	
CELL #1 (1989)					1.9				
CELL #2 (2018)					1.9				
LAKEFILLING SITE (1987)		2.0		1.9			1.6	1.7	
LAKEFILLING SITE +100 M		2.1							
LAKEFILLING SITE +250 M		2.0		1.9			1.6		
LAKEFILLING SITE +500 M				1.8		2.0			
LAKEFILLING SITE +1000 M				1.9					
MAIN STP OUTFALL (1419)	3.1	3.1		2.2			2.1	5.5	
RC HARRIS INTAKE (2029)	2.0	2.0		1.8			1.9	1.8	
ISLAND IN-PLANT RAW	1.9								
RC HARRIS RAW	1.9						2.0		
MAIN STP TREATED EFF	12.1			11.7			0.6		

APPENDIX A3

DATA LISTING FOR METALS

Notation Used:

"A" indicates an approximate result.
"<T" indicates a result which may not differ from zero.
"<" indicates result less than reported value.
"*" indicates a result in exceedance of the Provincial Water Quality Objectives for the protection of aquatic life and recreation.

PARAMETER : IRON
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 18 UG/L
MOE. OBJECTIVE: 300 UG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	400#		990#						
CHERRY ST (1379)							170		
DREDGE SITE (2017)	590#		890#						1400#
DREDGE SITE +100 M	280		890#						
DREDGE SITE +250 M	150		150						
INNER HARBOUR (1364)	120		63				210		69
ISLAND INTAKE (1536)	35	67	110	49			26	23	33
CELL #1 (1989)					1340#				
CELL #2 (2018)					270				84
LAKEFILLING SITE (1987)				310#			140	240	1400#
LAKEFILLING SITE +100 M		370#							
LAKEFILLING SITE +250 M		78		200			78		
LAKEFILLING SITE +500 M				100		930#			
LAKEFILLING SITE +1000 M				380#					
MAIN STP OUTFALL (1419)	170	350#		180			270	660#	290
RC HARRIS INTAKE (2029)	30	20		35			32	14	60
ISLAND IN-PLANT RAW	21								
RC HARRIS RAW							870#		
MAIN STP TREATED EFF	980#			760#			1100#		

PARAMETER : MANGANESE
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 2.0 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	9		66						
CHERRY ST (1379)							12		
DREDGE SITE (2017)	50		50						67
DREDGE SITE +100 M	21		53						
DREDGE SITE +250 M	11		12						
INNER HARBOUR (1364)	10		4				13		10
ISLAND INTAKE (1536)	2	6	5	3			3	2	2
CELL #1 (1989)					35				
CELL #2 (2018)					10				4
LAKEFILLING SITE (1987)			9				6	15	33
LAKEFILLING SITE +100 M		8							
LAKEFILLING SITE +250 M		1		7			4		
LAKEFILLING SITE +500 M				4		23			
LAKEFILLING SITE +1000 M				10					
MAIN STP OUTFALL (1419)	10	14		8			10	120	11
RC HARRIS INTAKE (2029)	3	1		2			2	2	3
ISLAND IN-PLANT RAW	2								
RC HARRIS RAW							35		
MAIN STP TREATED EFF	50			50			45		

PARAMETER : ALUMINUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 2.0 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	140		360						
CHERRY ST (1379)							120		
DREDGE SITE (2017)	310		430						
DREDGE SITE +100 M	160		430						
DREDGE SITE +250 M	120		110						
INNER HARBOUR (1364)	80		40				140		
ISLAND INTAKE (1536)	40	60	90	40			26	26	
CELL #1 (1989)					980				
CELL #2 (2018)					240				
LAKEFILLING SITE (1987)				260			110	1300	
LAKEFILLING SITE +100 M		170							
LAKEFILLING SITE +250 M		60		160			64		
LAKEFILLING SITE +500 M				85		730			
LAKEFILLING SITE +1000 M				310					
MAIN STP OUTFALL (1419)	120	180		110			210	54	
RC HARRIS INTAKE (2029)	40	17		300			44	18	
ISLAND IN-PLANT RAW	17								
RC HARRIS RAW							620		
MAIN STP TREATED EFF	200			100			310		

PARAMETER : ARSENIC
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MIN.OBJECTIVE : 100 UG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	<1		<1						
CHERRY ST (1379)							1		
DREDGE SITE (2017)	1		1						1
DREDGE SITE +100 M	1		1						
DREDGE SITE +250 M	1		1						
INNER HARBOUR (1364)	1		1				1		<1
ISLAND INTAKE (1536)	1	2	1	1			1	1	2
CELL #1 (1989)					<1				
CELL #2 (2018)					<1				<1
LAKEFILLING SITE (1987)				1			1	<1	<1
LAKEFILLING SITE +100 M		1							
LAKEFILLING SITE +250 M		1		1			1		
LAKEFILLING SITE +500 M				1		1			
LAKEFILLING SITE +1000 M				1					
MAIN STP OUTFALL (1419)	1	1		1			1	<1	<1
RC HARRIS INTAKE (2029)	1	1		1			1	<1	1
ISLAND IN-PLANT RAW	1								
RC HARRIS RAW							1		
MAIN STP TREATED EFF	1			1			1		

PARAMETER : BARIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 2.0 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	50		63						
CHERRY ST (1379)							28		
DREDGE SITE (2017)	40		38						38
DREDGE SITE +100 M	27		38						
DREDGE SITE +250 M	25		25						
INNER HARBOUR (1364)	20		24				27		23
ISLAND INTAKE (1536)	25	23	23	20			22	18	22
CELL #1 (1989)					33				
CELL #2 (2018)					24				22
LAKEFILLING SITE (1987)				22			24	35	33
LAKEFILLING SITE +100 M		24							
LAKEFILLING SITE +250 M		24		20			23		
LAKEFILLING SITE +500 M				20		24			
LAKEFILLING SITE +1000 M				21					
MAIN STP OUTFALL (1419)	20	23		19			23	19	22
RC HARRIS INTAKE (2029)	25	18		20			23	18	23
ISLAND IN-PLANT RAW	23								
RC HARRIS RAW							28		
MAIN STP TREATED EFF	17			13			23		

PARAMETER : BERYLLIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MOE. OBJECTIVE: 11 UG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	<1		<1						
CHERRY ST (1379)							<1		
DREDGE SITE (2017)	<1		<1						ND
DREDGE SITE +100 M	<1		<1						
DREDGE SITE +250 M	<1		<1						
INNER HARBOUR (1364)	<1		<1				<1		ND
ISLAND INTAKE (1536)	<1	<1	<1	<1			<1	<1	ND
CELL #1 (1989)					<1				
CELL #2 (2018)					<1				ND
LAKEFILLING SITE (1987)				<1			<1	<1	ND
LAKEFILLING SITE +100 M		<1							
LAKEFILLING SITE +250 M		<1		<1			<1		
LAKEFILLING SITE +500 M				<1		<1			
LAKEFILLING SITE +1000 M				<1					
MAIN STP OUTFALL (1419)	<1	<1		<1			<1	<1	ND
RC HARRIS INTAKE (2029)	<1	<1		<1			<1	<1	ND
ISLAND IN-PLANT RAW	<1								
RC HARRIS RAW							<1		
MAIN STP TREATED EFF	<1			<1			<1		

PARAMETER : CYANIDE(FREE)
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MOE. OBJECTIVE: 5 UG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	AS <T		5 <T						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	AS <T		5 <T						ND
DREDGE SITE +100 M	AS <T		5 <T						
DREDGE SITE +250 M	AS <T		5 <T						
INNER HARBOUR (1364)	AS <T		5 <T				ND		ND
ISLAND INTAKE (1536)	AS <T	5 <T	5 <T	5 <T			ND	ND	ND
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				ND
LAKEFILLING SITE (1987)		5 <T		5 <T			ND	ND	ND
LAKEFILLING SITE +100 M		5 <T							
LAKEFILLING SITE +250 M		5 <T		5 <T			ND		
LAKEFILLING SITE +500 M				5 <T		ND			
LAKEFILLING SITE +1000 M				5 <T					
MAIN STP OUTFALL (1419)	AS <T	5 <T		5 <T			2 <T	3 <T	ND
RC HARRIS INTAKE (2029)	5 <T	5 <T		5 <T			ND	ND	ND
ISLAND IN-PLANT RAW	AS <T								
RC HARRIS RAW							ND		
MAIN STP TREATED EFF	<T AS			6#.			20#.		

PARAMETER : CADMIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 0.2 UG/L
MOE. OBJECTIVE: 0.2

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	<.2		0.4#.						
CHERRY ST (1379)							<.2		
DREDGE SITE (2017)	<.2		<.2						0.5#.
DREDGE SITE +100 M	<.2		<.2						
DREDGE SITE +250 M	<.2		0.2						
INNER HARBOUR (1364)	<.2		<.2				<.2		0.3#.
ISLAND INTAKE (1536)	<.2	<.2	<.2	<.2			<.2	0.3#.	0.5#.
CELL #1 (1989)					<.2				
CELL #2 (2018)					<.2				0.3#.
LAKEFILLING SITE (1987)				<.2			<.2	0.5#.	0.4#.
LAKEFILLING SITE +100 M		18.0#.							
LAKEFILLING SITE +250 M		<.2		0.2			<.2		
LAKEFILLING SITE +500 M				<.2		<.2			
LAKEFILLING SITE +1000 M				<.2					
MAIN STP OUTFALL (1419)	<.2	0.2		<.2			<.2	7.0#.	0.4#.
RC HARRIS INTAKE (2029)	<.2	<.2		<.2			<.2	0.3#.	0.3#.
ISLAND IN-PLANT RAW	<.2								
RC HARRIS RAW							<.2		
MAIN STP TREATED EFF	0.4#.			0.6#.			10.0#.		

PARAMETER : COBALT
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)	<1		1						
CHERRY ST (1379)							<1		
DREDGE SITE (2017)	1		1						2
DREDGE SITE +100 M	<1		1						
DREDGE SITE +250 M	<1		<1						
INNER HARBOUR (1364)	<1		<1				<1		1
ISLAND INTAKE (1536)	<1	<1	<1	<1			<1	<1	2
CELL #1 (1989)					1				
CELL #2 (2018)					<1				1
LAKEFILLING SITE (1987)				<1			<1	<1	2
LAKEFILLING SITE +100 M		<1							
LAKEFILLING SITE +250 M		<1		<1			<1		
LAKEFILLING SITE +500 M				<1		1			
LAKEFILLING SITE +1000 M				1					
MAIN STP OUTFALL (1419)	<1	<1		<1			<1	2	1
RC HARRIS INTAKE (2029)	<1	<1		<1			<1	<1	1
ISLAND IN-PLANT RAW	<1								
RC HARRIS RAW							1		
MAIN STP TREATED EFF	3			2			2		

PARAMETER : CHROMIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MOE. OBJECTIVE: 100 UG/L

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)	5		12						
CHERRY ST (1379)							3		
DREDGE SITE (2017)	5		29						5
DREDGE SITE +100 M	2		29						
DREDGE SITE +250 M	2		2						
INNER HARBOUR (1364)	1		1				2		67
ISLAND INTAKE (1536)	2	<1	1	9			2	<1	14
CELL #1 (1989)					3				
CELL #2 (2018)					2				5
LAKEFILLING SITE (1987)				7			3	5	5
LAKEFILLING SITE +100 M		2							
LAKEFILLING SITE +250 M		3		9			3		
LAKEFILLING SITE +500 M				12		2			
LAKEFILLING SITE +1000 M				8					
MAIN STP OUTFALL (1419)	5	8		11			5	4	13
RC HARRIS INTAKE (2029)	1	1		25			6	<1	1
ISLAND IN-PLANT RAW	<1								
RC HARRIS RAW							4		
MAIN STP TREATED EFF	20			160#.			30		

PARAMETER : MERCURY UNF., TOTAL
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 0.01 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)	A.03		.13						
CHERRY ST (1379)							.06		
DREDGE SITE (2017)	.11		.07						.02
DREDGE SITE +100 M	.12		.08						
DREDGE SITE +250 M	.12		.08						
INNER HARBOUR (1364)	.15		.06				.06		.01
ISLAND INTAKE (1536)	.12	.11	.06	.24			.06	.01	.01
CELL #1 (1989)					.03				
CELL #2 (2018)					.09				.01
LAKEFILLING SITE (1987)		.18		.05			.06	.02	.04
LAKEFILLING SITE +100 M		.19							
LAKEFILLING SITE +250 M		.15		.08			.06		
LAKEFILLING SITE +500 M				.08		.07			
LAKEFILLING SITE +1000 M				.05					
MAIN STP OUTFALL (1419)	.08	.11		.06			.06	.02	.02
RC HARRIS INTAKE (2029)	.06	.22		.06			.06	.01	.01
ISLAND IN-PLANT RAW	.03								
RC HARRIS RAW	A.03						.06		
MAIN STP TREATED EFF	A.03			.04			.06		

PARAMETER : MERCURY FIL., TOTAL
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 0.06 UG/L
MOE. OBJECTIVE: 0.2

LOCATION	1982 SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	1983 APR26.	JUN30.
DON RIVER (2020)			.11						
CHERRY ST (1379)							<.06		
DREDGE SITE (2017)			.08						
DREDGE SITE +100 M			.07						
DREDGE SITE +250 M			.06						
INNER HARBOUR (1364)			.07				<.06		
ISLAND INTAKE (1536)	.20	.12	.06	.24#.			<.06		
CELL #1 (1989)									
CELL #2 (2018)					.09				.01
LAKEFILLING SITE (1987)		.18					<.06		
LAKEFILLING SITE +100 M		.19							
LAKEFILLING SITE +250 M		.15					<.06		
LAKEFILLING SITE +500 M						.06			
LAKEFILLING SITE +1000 M									
MAIN STP OUTFALL (1419)	.24#.	.11					<.06		
RC HARRIS INTAKE (2029)	.13	.22#.					<.06		
ISLAND IN-PLANT RAW									
RC HARRIS RAW							<.06		
MAIN STP TREATED EFF							<.06		

PARAMETER : MOLYBDENUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	2		1						
CHERRY ST (1379)							2		
DREDGE SITE (2017)	2		2						<1
DREDGE SITE +100 M	1		2						
DREDGE SITE +250 M	2		<1						
INNER HARBOUR (1364)	<1		2				2		2
ISLAND INTAKE (1536)	1	1	2	1			1	2	4
CELL #1 (1989)					1				
CELL #2 (2018)					2				3
LAKEFILLING SITE (1987)				1			2	<1	<1
LAKEFILLING SITE +100 M		1							
LAKEFILLING SITE +250 M		1		1			2		
LAKEFILLING SITE +500 M				1		2			
LAKEFILLING SITE +1000 M				2					
MAIN STP OUTFALL (1419)	3	3		2			2	4	3
RC HARRIS INTAKE (2029)	2	<1		1			2	2	2
ISLAND IN-PLANT RAW	1								
RC HARRIS RAW							3		
MAIN STP TREATED EFF	13			16			10		

PARAMETER : NICKEL
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MOE. OBJECTIVE: 25 UG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	5		4						
CHERRY ST (1379)							4		
DREDGE SITE (2017)	2		15						5
DREDGE SITE +100 M	5		15						
DREDGE SITE +250 M	2		1						
INNER HARBOUR (1364)	1		1				4		2
ISLAND INTAKE (1536)	1	1	2	1			2	2	3
CELL #1 (1989)					2				
CELL #2 (2018)					<1				3
LAKEFILLING SITE (1987)				2			3	11	6
LAKEFILLING SITE +100 M		2							
LAKEFILLING SITE +250 M		2		2			3		
LAKEFILLING SITE +500 M				1		1			
LAKEFILLING SITE +1000 M				2					
MAIN STP OUTFALL (1419)	7	7		6			4	6	5
RC HARRIS INTAKE (2029)	1	<1		2			2	2	
ISLAND IN-PLANT RAW	<1								
RC HARRIS RAW							3		
MAIN STP TREATED EFF	40#.			50#.			35#.		

PARAMETER : LEAD
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 3.0 UG/L
MOE. OBJECTIVE: 25 UG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	<3		14						
CHERRY ST (1379)							<3		
DREDGE SITE (2017)	3		6						20
DREDGE SITE +100 M	<3		6						
DREDGE SITE +250 M	4		3						
INNER HARBOUR (1364)	<3		3				3		5
ISLAND INTAKE (1536)	4	4	6	6			<3	<3	7
CELL #1 (1989)					10				
CELL #2 (2018)					<3				4
LAKEFILLING SITE (1987)							4	6	12
LAKEFILLING SITE +100 M		<3		5					
LAKEFILLING SITE +250 M		<3		6			<3		
LAKEFILLING SITE +500 M				4		<3			
LAKEFILLING SITE +1000 M				6					
MAIN STP OUTFALL (1419)	<3	5		5			<3	9	4
RC HARRIS INTAKE (2029)	<3	<3		4			<3	<3	6
ISLAND IN-PLANT RAW	<3								
RC HARRIS RAW							5		
MAIN STP TREATED EFF	20			14			25		

PARAMETER : SELENIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1 UG/L
MOE. OBJECTIVE: 100 UG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	<1		<1						
CHERRY ST (1379)							<1		
DREDGE SITE (2017)	<1		<1						1
DREDGE SITE +100 M	<1		<1						
DREDGE SITE +250 M	<1		<1						
INNER HARBOUR (1364)	<1		<1				<1		<1
ISLAND INTAKE (1536)	<1	<1	<1	<1			<1	<1	1
CELL #1 (1989)					<1				
CELL #2 (2018)					<1				<1
LAKEFILLING SITE (1987)				<1			<1	<1	1
LAKEFILLING SITE +100 M		<1							
LAKEFILLING SITE +250 M		<1		<1			<1		
LAKEFILLING SITE +500 M				<1		<1			
LAKEFILLING SITE +1000 M				<1					
MAIN STP OUTFALL (1419)	<1	<1		<1			<1	<1	<1
RC HARRIS INTAKE (2029)	<1	<1		<1			<1	<1	<1
ISLAND IN-PLANT RAW	<1								
RC HARRIS RAW							<1		
MAIN STP TREATED EFF	<1			<1			<1		

PARAMETER : STRONTIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	100		330						
CHERRY ST (1379)							190		
DREDGE SITE (2017)	210		200						190
DREDGE SITE +100 M	180		200						
DREDGE SITE +250 M	190		190						
INNER HARBOUR (1364)	160		180				190		180
ISLAND INTAKE (1536)	190	180	180	160			170	140	170
CELL #1 (1989)					180				
CELL #2 (2018)					180				170
LAKEFILLING SITE (1987)				160			180	170	170
LAKEFILLING SITE +100 M		180							
LAKEFILLING SITE +250 M		190		160			170		
LAKEFILLING SITE +500 M				160		160			
LAKEFILLING SITE +1000 M				150					
MAIN STP OUTFALL (1419)	190	180		150			160	740	170
RC HARRIS INTAKE (2029)	180	150		160			180	130	170
ISLAND IN-PLANT RAW	190								
RC HARRIS RAW							180		
MAIN STP TREATED EFF	200			190			170		

PARAMETER : TITANIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	30		10						
CHERRY ST (1379)							26		
DREDGE SITE (2017)	<1		<1						27
DREDGE SITE +100 M	<1		<1						
DREDGE SITE +250 M	5		8						
INNER HARBOUR (1364)	<1		<1				16		<1
ISLAND INTAKE (1536)	<1	<1	6	<1			14	<2	<1
CELL #1 (1989)					8				
CELL #2 (2018)					54				<1
LAKEFILLING SITE (1987)				4			17	59	40
LAKEFILLING SITE +100 M		10							
LAKEFILLING SITE +250 M		8		2			15		
LAKEFILLING SITE +500 M				<1		23			
LAKEFILLING SITE +1000 M				4					
MAIN STP OUTFALL (1419)	2	4		<1			18	6	7
RC HARRIS INTAKE (2029)	<1	10		<1			16	<2	
ISLAND IN-PLANT RAW	<1								
RC HARRIS RAW							30		
MAIN STP TREATED EFF	1			<1			16		

PARAMETER : VANADIUM
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1 UG/L
MOE. OBJECTIVE: NONE

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	2		3						
CHERRY ST (1379)							2		
DREDGE SITE (2017)	2		2						4
DREDGE SITE +100 M	1		2						
DREDGE SITE +250 M	1		1						
INNER HARBOUR (1364)	1		1				2		2
ISLAND INTAKE (1536)	1	1	1	1			1	<1	2
CELL #1 (1989)					3				
CELL #2 (2018)					2				2
LAKEFILLING SITE (1987)				2			2	4	4
LAKEFILLING SITE +100 M		1							
LAKEFILLING SITE +250 M		<1		1					
LAKEFILLING SITE +500 M				1		3			
LAKEFILLING SITE +1000 M				2					
MAIN STP OUTFALL (1419)	1	1		1			2	2	2
RC HARRIS INTAKE (2029)	1	<1		1			1	<1	1
ISLAND IN-PLANT RAW	<1								
RC HARRIS RAW							2		
MAIN STP TREATED EFF	2			1			2		

PARAMETER : ZINC
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MIN.OBJECTIVE : 30 UG/L

LOCATION	1982						1983		
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	10		50#.						
CHERRY ST (1379)							6		
DREDGE SITE (2017)	15		14						38#.
DREDGE SITE +100 M	4		14						
DREDGE SITE +250 M	3		4						
INNER HARBOUR (1364)	3		3				9		3
ISLAND INTAKE (1536)	2	2	5	3			3	6	1
CELL #1 (1989)					19				
CELL #2 (2018)					4				2
LAKEFILLING SITE (1987)				3			4	78#.	13
LAKEFILLING SITE +100 M		18							
LAKEFILLING SITE +250 M		2		2			2		
LAKEFILLING SITE +500 M				2		7			
LAKEFILLING SITE +1000 M				5					
MAIN STP OUTFALL (1419)	5	10		3			4	87#.	4
RC HARRIS INTAKE (2029)	2	<1		2			2	3	3
ISLAND IN-PLANT RAW	4								
RC HARRIS RAW							18		
MAIN STP TREATED EFF	36#.			28			49#.		

PARAMETER : COPPER
UNITS : UG/L

MIN. REPORTABLE CONCENTRATION : 1.0 UG/L
MOE. OBJECTIVE: 5.0

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	9#.		50#.						
CHERRY ST (1379)							7#.		
DREDGE SITE (2017)	13#.		10#.						14#.
DREDGE SITE +100 M	8#.		8#.						
DREDGE SITE +250 M	5		5						
INNER HARBOUR (1364)	4		8#.				10#.		7#.
ISLAND INTAKE (1536)	4	4	8#.	<1			6#.	7#.	7#.
CELL #1 (1989)					9#.				
CELL #2 (2018)					6#.				6#.
LAKEFILLING SITE (1987)				2			5	100#.	10#.
LAKEFILLING SITE +100 M		4							
LAKEFILLING SITE +250 M		4		<1			6#.		
LAKEFILLING SITE +500 M				<1		5			
LAKEFILLING SITE +1000 M				<1					
MAIN STP OUTFALL (1419)	6#.	9#.		<1			7#.	30#.	8#.
RC HARRIS INTAKE (2029)	4	3		2			6#.	6#.	7#.
ISLAND IN-PLANT RAW	19#.								
RC HARRIS RAW							30#.		
MAIN STP TREATED EFF	250#.			170#.			530#.		

PARAMETER : SILVER
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 50 NG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	ND		ND						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	ND		ND						
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			ND		
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				
LAKEFILLING SITE (1987)		ND		ND			ND		
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			ND		
RC HARRIS INTAKE (2029)	ND	ND		ND			ND		
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF	70			ND			ND		

APPENDIX A4

DATA LISTING FOR TRACE ORGANICS

Notation Used:

"A" indicates an approximate result.
" <T" indicates a result which may not differ from zero.
" < " indicates result less than reported value.
"ND" indicates not detected above the minimum reportable concentration.
"*" indicates a result in exceedance of the Provincial Water Quality Objectives for the protection of aquatic life and recreation.

PARAMETER : ALPHA BHC
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 1 NG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	8		5						
CHERRY ST (1379)							4		
DREDGE SITE (2017)	8		10						4
DREDGE SITE +100 M	6		7						
DREDGE SITE +250 M	4		ND						
INNER HARBOUR (1364)	10		7				4		ND
ISLAND INTAKE (1536)	5	4	7	3			5	2	
CELL #1 (1989)					8				
CELL #2 (2018)									4
LAKEFILLING SITE (1987)		5		6			4	3	5
LAKEFILLING SITE +100 M		5							
LAKEFILLING SITE +250 M		6		4			4		
LAKEFILLING SITE +500 M				7					
LAKEFILLING SITE +1000 M				5					
MAIN STP OUTFALL (1419)	6	7		6			4	2	5
RC HARRIS INTAKE (2029)	6	6		3			4	3	5
ISLAND IN-PLANT RAW	4								
RC HARRIS RAW							5		
MAIN STP TREATED EFF				15			4		

PARAMETER : BETA BHC
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 1 NG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	ND		ND						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	ND		ND						3
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			ND	ND	
CELL #1 (1989)					ND				
CELL #2 (2018)									ND
LAKEFILLING SITE (1987)		ND		ND			ND	ND	ND
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND					
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			7	ND	ND
RC HARRIS INTAKE (2029)	ND	ND		ND			ND	ND	ND
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF				4			25*		

PARAMETER : GAMMA BHC (LINDANE)
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 1 NG/L
MOE. OBJECTIVE: 10 NG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	4		ND						
CHERRY ST (1379)							3		
DREDGE SITE (2017)	2		4						ND
DREDGE SITE +100 M	ND		2						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	2		ND				2		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			2	ND	
CELL #1 (1989)					ND				
CELL #2 (2018)									ND
LAKEFILLING SITE (1987)		ND		ND			ND	ND	ND
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND					
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			3	6	2
RC HARRIS INTAKE (2029)	ND	ND		ND			ND	ND	ND
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF				6			25*		

PARAMETER : HCB
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 1 NG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	4		ND						
CHERRY ST (1379)							1		
DREDGE SITE (2017)	3		ND						
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			ND		
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				ND
LAKEFILLING SITE (1987)		1		ND			1	ND	ND
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	2	2		2			5	2	ND
RC HARRIS INTAKE (2029)	ND	ND		1			ND	ND	ND
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF				27			115		

PARAMETER : TOTAL PCB
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 20 NG/L
MOE. OBJECTIVE: 1 NG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	ND		ND						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	ND		ND						
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			ND		
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				
LAKEFILLING SITE (1987)		ND		ND			ND		
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			ND		
RC HARRIS INTAKE (2029)	ND	ND		ND			ND		
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF				20%			35%		

PARAMETER : CHLORDANE
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 2 NG/L
MOE. OBJECTIVE: 60 NG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	ND		ND						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	ND		ND						
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			ND		
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				
LAKEFILLING SITE (1987)		ND		ND			ND	ND	2
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			ND		
RC HARRIS INTAKE (2029)	ND	ND		ND			ND		
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF				ND			ND		

PARAMETER : DIELDRIN
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 2 NG/L
MOE. OBJECTIVE: 1 NG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	ND		ND						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	ND		ND						
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			ND		
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				
LAKEFILLING SITE (1987)		ND		ND			ND	ND	10%
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			ND		
RC HARRIS INTAKE (2029)	ND	ND		ND			ND		
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF				ND			ND		

PARAMETER : PP DDE
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION : 1 NG/L
MOE. OBJECTIVE: SUM DDT 1 NG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	ND		ND						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	ND		ND						ND
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	ND	ND	ND	ND			ND	ND	
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				ND
LAKEFILLING SITE (1987)		ND		ND			ND	ND	ND
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			ND	1	ND
RC HARRIS INTAKE (2029)	ND	ND		ND			ND	ND	ND
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF	ND			ND			ND		

PARAMETER : 2,4-D
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION :100 NG/L
MOE. OBJECTIVE: NONE

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	450		230						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	330		ND						
DREDGE SITE +100 M	ND		200						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	200		ND				ND		ND
ISLAND INTAKE (1536)	300	ND	ND	ND			ND		
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				
LAKEFILLING SITE (1987)		ND		ND			ND		
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			ND		
RC HARRIS INTAKE (2029)	ND	ND		ND			ND		
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF	ND			ND			330		

PARAMETER : DICAMBA
UNITS : NG/L

MIN. REPORTABLE CONCENTRATION :100 NG/L
MOE. OBJECTIVE: 200,000 NG/L

LOCATION	1982							1983	
	SEP21.	SEP22.	SEP29.	OCT15.	NOV 4.	NOV 5.	DEC 1.	APR26.	JUN30.
DON RIVER (2020)	150		140						
CHERRY ST (1379)							ND		
DREDGE SITE (2017)	ND		ND						
DREDGE SITE +100 M	ND		ND						
DREDGE SITE +250 M	ND		ND						
INNER HARBOUR (1364)	ND		ND				ND		ND
ISLAND INTAKE (1536)	140	ND	ND	ND			ND		
CELL #1 (1989)					ND				
CELL #2 (2018)					ND				
LAKEFILLING SITE (1987)		ND		ND			ND		
LAKEFILLING SITE +100 M		ND							
LAKEFILLING SITE +250 M		ND		ND			ND		
LAKEFILLING SITE +500 M				ND		ND			
LAKEFILLING SITE +1000 M				ND					
MAIN STP OUTFALL (1419)	ND	ND		ND			ND		
RC HARRIS INTAKE (2029)	ND	ND		ND			ND		
ISLAND IN-PLANT RAW	ND								
RC HARRIS RAW	ND						ND		
MAIN STP TREATED EFF	ND			ND			ND		

APPENDIX A5: DATA LISTING FOR SEDIMENT ANALYSIS

PARAMETER	DRY WEIGHT CONCENTRATIONS (ppm)			
	Dredged Spoils	Centrifuged Particulates		
	(21 09 1982)	(04 11 1982)		(05 11 1982)
	Composite Grab	1989	2018	1987+500m
pH	7.6			
Total P	1600			
Total Kjeldahl N	1600			
Aluminum	10000			
Arsenic	10.77	13.20	8.42	8.35
Barium	73			
Beryllium	1.10			
Cadmium	1.70	2.90	3.70	0.86
Cobalt	8.10			
Chromium	43	51	58	30
Copper	58	88	92	48
Iron	19000	25000	26000	20000
Manganese	390	580	700	490
Molybdenum	2.50			
Nickel	19	27	28	20
Lead	170	180	240	120
Selenium	0.51			
Strontium	120			
Titanium	560			
Vanadium	32			
Zinc	230	270	360	160
Oil/Grease	3800			
alpha-BHC	0.005	ND	ND	ND
beta-BHC	0.004	ND	ND	ND
alpha-Chlordane	0.018	ND	ND	0.004
gamma-Chlordane	0.012	ND	ND	0.007
Dieldrin	0.004	ND	ND	ND
Total PCBs	0.320	ND	ND	0.024
pp-DDD	0.010	ND	ND	ND
HCB	0.006	ND	ND	ND
2,4,5 T	ND	ND	0.220	ND
Picloram	ND	0.140	ND	ND
Silvex	ND	0.670	ND	ND

ND = not detected

Only those parameters which were detected at least once have been included in the above table.